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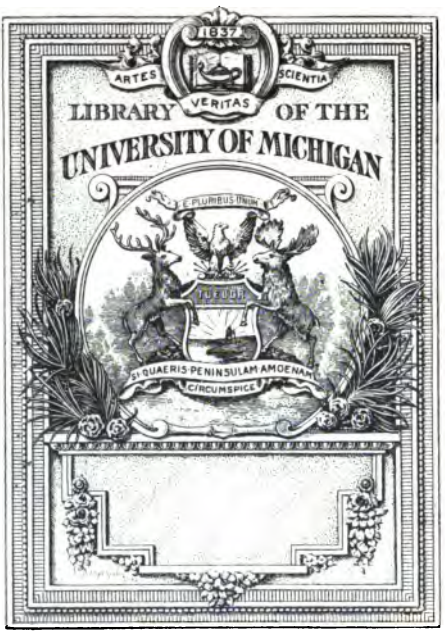
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TRUCK-FARMING

AT THE

SOUTH.

A Guide to the Raising of Vegetables for Northern Markets.

BY

DR. A. OEMLER,

PRESIDENT OF THE CHATHAM CO., GEORGIA, FRUIT AND VEGETABLE GROWERS ASSOCIATION.

NEW AND REVISED EDITION.

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CONTENTS.

PAGE

Preface 5

CHAPTER I.

Labor 7

CHAPTER II.

Soil and its Preparation 10

CHAPTER III.

Manures, their Kinds and Uses 15

CHAPTER IV.

The Rotation of Crops 54

CHAPTER V.

Weeds 59

CHAPTER VI.

Seed and Seed Sowing 62

CHAPTER VII.

Hot-Beds, Cold Frames and Weather 71

CHAPTER VIII.

Transplanting 82

CHAPTER IX.

Water and Watering 87

CHAPTER X.

Packing and Markets 90

CHAPTER XI.

Insects and their Remedies 96

CHAPTER XII.

Asparagus 119

CHAPTER XIII.

Beans, Bush or Snap 130

CHAPTER XIV.

Beet 134

CHAPTER XV.

Cabbage 137

CHAPTER XVI.
Cauliflower.....163

CHAPTER XVII.
Cucumber.....169

CHAPTER XVIII.
Egg Plant or Guinea Squash.....175

CHAPTER XIX.
Kale, Borecole or Sprouts.....178

CHAPTER XX.
Lettuce.....180

CHAPTER XXI.
Onions.....181

CHAPTER XXII.
Pea.....191

CHAPTER XXIII.
Potato.....195

CHAPTER XXIV.
Radish.....207

CHAPTER XXV.
Spinach.....208

CHAPTER XXVI.
Squash.....209

CHAPTER XXVII.
Sweet Potato.....213

CHAPTER XXVIII.
Tomato.....220

CHAPTER XXIX.
Watermelon.....229

CHAPTER XXX.
Strawberry.....236

APPENDIX.

Analyses and Values of Fertilizers.....252
Economy in Fertilization.....257
Formula for Composts.....259
Useful Tables.....262

PREFACE.

THIS work is written in the hope that it may be useful to my fellow farmers who are engaged in growing vegetables for the Northern markets. The instructions given, and facts presented, are mainly such as are not to be found in the few works extant on Southern gardening, and are those resulting from a long experience. When I commenced to produce vegetables for shipment, about twenty-six years ago, there were few or none following the pursuit as an exclusive business on a large scale. The consignments at that time consisted mainly of the mere surplus crops of the local market gardeners. The business has gradually developed to astonishing proportions, principally in the vicinity of the larger seaport cities of the South. One of the results has been that land within three miles of Savannah, for instance, has risen in value one hundred and fifty per cent. within the last twelve years. While the crops of the whole area tributary to Savannah, were by no means satisfactory during the past season, the aggregate quantity of produce was large. The following statement shows the produce forwarded to the Northern markets direct from the port of Savannah by the steamships alone.

EXPORTS (BY STEAMERS) OF VEGETABLES (AND ORANGES FROM FLORIDA), FOR THE SEASON ENDING AUGUST 31st, 1882.

PORT.	VEGETABLES.		ORANGES.		TOTAL OF PACKAGES.
	Crates.	*Barrels.*	*Boxes.*	*Barrels.*	
New York	105,739	27,572	69,379	2,519	205,209
Baltimore	50,787	12,696	2,723	907	67,113
Philadelphia	24,472	7,956	13,033	445	45,906
Boston	4,132	630	9,837	174	14,773
	185,130	48,854	94,972	4,045	333,001

The season's shipment of melons to New York aggregated 175,000.

Of course, failures will occur in this, as in every other pursuit; but where favorable conditions of soil, situation, etc., exist, sober, economical, industrious, and intelligent farmers who attend closely to their business, can make this a most profitable branch of agriculture. As an instance of successful truck-farming, I may cite a case within my knowledge. Among the prosperous gardeners near Savannah, are three brothers, plain farmers from Effingham County, Georgia. They were without any special advantages as educated horticulturists, but under favorable contingencies, and possessing in themselves the above named desirable characteristics, they commenced to farm on their own account seven years ago. They had a borrowed capital of one thousand dollars wherewith to operate their first small crop, and make a payment on account of their purchase of land. They were not only able to pay for the land in full, from the proceeds of their crops, but have acquired in the aggregate two hundred and seventy-five acres, making at various intervals cash payments ranging from one thousand five hundred dollars to nine thousand one hundred dollars. Besides this, they have expended various amounts in buildings, and other improvements, and have cash on hand and a bank account. One of the brothers has also invested in railroad stock, and the elder of them has lately purchased a house and lot in town, for four thousand five hundred dollars, while there is not a mortgage, or lien, of any kind, on any of the property of the brothers.

A. O.

TRUCK-FARMING AT THE SOUTH.

CHAPTER I.

LABOR.

Owing to the perishable nature of the products, the areas at the South devoted to truck-farming must remain confined to certain limits. These will be near the larger cities and along the routes of railroads, by which products can be safely and expeditiously dispatched to market. Although truck-farming can employ but a comparatively small proportion of the labor of the South, it must be followed according to the same principles and system that govern general agriculture.

The negro must be accepted as the only practical solution of the labor question, and, notwithstanding his instability, he is the best for many reasons. It would be impolitic, even were it possible, to trust to more intelligent and energetic laborers from abroad, and mix the two races as field laborers. No dependence could be placed upon retaining the foreign help, as his greater energy and a praiseworthy desire for self-elevation would soon prompt the emigrant, or white laborer, to change his status and better his condition.

Accepting the negro as the God-given instrument for the development of the agricultural resources of the South, while profiting by his general wastefulness and improvidence for his own good and our own, it should be the constant aim of every employer, who has the welfare of southern agriculture at heart, to elevate the laborer. The employer can, by strict justice, fairness and

even kindness, render him satisfied with his lot, to the end, that, instead of being an irritating element of the body politic, he may become a contented and useful member thereof. Exceptional instances of self-elevation and independence should be correctly appreciated and encouraged as a spur to others.

The death of slavery was, so to speak, the birth of truck-farming on an extensive scale in the South-Atlantic and Gulf States; indeed it would otherwise have been impossible. I was probably the largest slave-owner, engaged in vegetable culture, in this section; but of forty-five grown negroes, twenty-six only were available as field laborers, the others being mechanics, house-servants, etc.; and at no time could I have controlled more than that number of hands, and few, or none, could have been hired. At the present time there are in the vicinity of Savannah many truck-farmers who employ one hundred to two hundred laborers during the picking season.

Ex-Governor Hammond's prediction: that the negro, in case of emancipation would "seek the towns, and rapidly accumulate in groups upon their outskirts," has certainly been verified. It is the better class of this population, those who are willing to do some work, which supplies the truck-farmer with sufficient labor during the pressing season of gathering his crops. The table below gives the usual average rate of wages, without board, paid by truck-farmers in the vicinity of Savannah.

	By the day.	*Picking large Peas per bushel-basket.*	*Picking early Peas or Beans per basket.*	*Making crates for Peas or Beans per 100.*	*Making crates for Cucumb's and Tomatoes, per 100.*	*Picking Strawberries per quart.*	*Packing Strawberries per quart.*
For men.....	60 c.	12½–15 c	20 c.	$1.00	$0.75	1½ c.	1 c.
For women.....	50 c.	12½–15 c	20 c.	.....	.....	1½ c.	1 c.

Three baskets fill four crates. When boys and girls are hired the pay is at half rate per day.

A few of the most efficient and trustworthy hands, who are particularly useful during the marketing season, and receive an increased pay, are selected to care for stock. Some farmers pay selected hands five cents per basket and one cent per crate additional for packing cucumbers and tomatoes; while others use the gang of day laborers for the purpose, depending upon their personal supervision to prevent injudicious gathering. For cutting hay with scythes, men are allowed one-third the cured hay, to be bought (at option of the hand or not, as may be agreed upon), by the employer at four dollars per rack-load of about eight hundred pounds.

The hours of labor are from sunrise to sunset, with variable allowances for meals during the different seasons of the year.

During the shipping season there is no fixed time for breaking off work; but extra pay is generally allowed in case of much night work.

If the hands are made to bestir themselves properly during their work, it is not unreasonable they should expect that the employer will not delay, or hesitate, in delivering compensation. Apart from considerations of justice, it is considered his policy to pay promptly after breaking off work on Saturday and before the stores are closed. Hands of the better order, and these are to be encouraged, may be depended upon to present themselves on Monday morning, whether in funds or not; but by far the greater majority will require time on Monday to get rid of their money, if they have had no opportunity of so doing Saturday evening and night, and will be absent at roll-call.

According to the report of the Agricultural Department of 1879, the latest authority at command, the average rate of wages paid, without board, in the interior of Georgia, was ten dollars and seventy-three cents per month.

CHAPTER II.

SOIL AND ITS PREPARATION.

The requisites the truck-farmer must have in view in selecting a location, are cheap, safe, and expeditious transportation of produce to market, convenience for procuring manure, a soil adapted to the crops he wishes to grow, and sanitary surroundings. Other conditions being the same, water carriage is preferable to that by wagon. If in the selection of the land, one is confined to a single soil, he should select one consisting of a mixture of organic and inorganic matter; a light, deep, sandy loam, with plenty of humus, or vegetable matter. Experience has shown that, without this, crops will not yield as well in proportion to the quantity of manure applied. Locations in the immediate vicinity of the larger coast cities, offering the best facilities in the way of transportation and manure, are in the possession of market gardeners, and such lands are generally highly fertile. The truck-farmer requiring a larger area is compelled to locate several miles beyond the corporate limits, on the line of a railroad, or on the banks of a navigable stream. The farm will often be one, the fertility of which has been shipped off to Europe, or the North, in the shape of cotton, by some planter, whose measure of success was gauged by the rapidity with which he could exhaust his soil. The renovation of the land will be the first desideratum. To that end, and the consequent production of remunerative crops, the plowing under of green manures, the application of fertilizers, proper preparation, careful tillage, and deep plowing, will be necessary. With every additional inch of depth in plowing in the first eighteen inches of the surface, the farmer gains six million two hundred and seventy-

two thousand six hundred and forty cubic inches per acre of available soil, with its mineral ingredients, and constantly increasing capacity of gathering, retaining, and supplying plant food. The conditions of quality of soil and climate being the same, the productiveness of soils must be in proportion to its mass. Sir J. B. Lawes found five thousand seven hundred pounds of nitrogen per acre in the first nine inches of his soil. The Russian black lands, which are held to be the richest in the world, have, according to Prof. Schmidt, within three feet of the surface, from forty thousand to forty-four thousand pounds of nitrogen. Several analyses of Boussingault showed from twenty-five thousand to thirty-two thousand pounds per acre beneath the surface, and a soil analyzed by Prof. Vœlcker, in 1868, showed eight thousand four hundred and twenty-five pounds per acre. The practice of deep plowing will depend upon circumstances; a good, though shallow mould, or other soil, resting upon a sticky, clay subsoil, would not be benefited by being at once broken up deeply, bringing large, hard lumps of unfertile clay to the surface, and deteriorating the physical quality of the top-soil.

DRAINAGE.

Drainage, more especially underdrainage, renders a clay subsoil, when moved by the plow, more susceptible to pulverization, and in such case a thorough drainage would have to precede deep plowing. Underdrainage prevents the drowning out of crops after heavy rainfalls. It increases the fertility and pulverization of the soil by admitting air. It keeps the ground moister in a dry season. It prevents the washing away of the soil and its fertilizing materials. It permits the farmer to work his land sooner after heavy rain, and earlier in the spring, and it prevents the land from becoming sour

in wet seasons. The total absence of water would be destructive to vegetation, for it is itself necessary to plant life; but undrained land is not merely wet, it becomes water-logged, and through absence of air, the plants are drowned out. When, however, water passes through, and away from the land, air takes its place, and also passes through the drains, and finds its way into the overlying soil, increasing its fertility and pulverizing it. The reason why drained land gains heat, and the temperature of water-logged land decreases, is the lack of heat-conducting power in water, or the fact that air can not be transmitted downwards through water. When land is saturated with water, the heat is expended in evaporating the moisture, instead of warming the land, and during this evaporation the temperature is reduced. Undrained land becomes sour in wet weather, and the formation of substances injurious to vegetation is encouraged. The absorbing power of soil is so great that ammonia and other fertilizing agents of water and air are arrested in their passage through it, thus enriching the soil; while the water on undrained land washes over the surface, carrying off into the water courses the fertility that might be saved. In undrained land, the passage of moisture, encouraged by evaporation from the surface, is upwards, whereas in drained land, the current is downwards to the level of the drains, supplying the roots with aërated moisture in condition to be taken up by them. An excess of water in the soil produces such a saturated state of the atmosphere, as to prevent a healthy perspiratory action of the leaves of plants growing upon it, and growth is retarded.

PREPARING THE SOIL.

Efficient drainage being provided, the land should be broken up and pulverized as deeply as possible. A mass

of sticky clay will absorb a slight amount of moisture, but when it is reduced to a powdered condition, its absorbing power will be very much increased. One hundred grains of fine clay left for twelve hours in contact with a solution of caustic potash, the latter not filtered through it, absorbed one thousand and fifty grains of potash.

Soils have the power of separating ammonia, and other bases from their solutions, and of separating alkaline bases from the acids with which they were combined.

Soils possessing the greatest amount of capillary porosity, most friable and mellow, or, in other words, such as are in the best agricultural condition, will condense the greatest amount of fertilizing material; and the more they are pulverized, the better will they resist the leaching action of water. Soil in an improper physical condition may hold fertilizing materials in sufficient quantities for a full crop. It will, however, yield only a small percentage to the vegetation upon it, until it is made friable, and so becomes conducive to growth. Carbonic acid is one of the chief agents in this process; and in order that this acid may be formed, the carbonaceous matter in the soil must be brought in direct contact with the atmosphere. As long as the soil is in a compact condition, or is saturated with water, carbonic acid is not formed. During the recent severe drouths it has been observed that crops growing on deeply-plowed land have suffered the least, for the reason that the greater the mass of fine soil, the greater must have been the amount of moisture absorbed. Heat is evolved during the decomposition of vegetable matter; and the darker the soil is from decomposing vegetable matter, the warmer will it become. The warmth of light-colored sands is attributable to their conductive power. Half the crop depends sometimes upon the previous preparation of the land. Owing to the absence of a covering of snow and of successive freezings and thawings, fall plowing, so useful at

the North, is destructive of fertility at the South and is not advisable.

CULTIVATION.

The land having been properly prepared by plowing, and sufficiently manured, and the crop planted with regard to the capacity of the soil, the most important matter to the farmer is, thorough culture, or keeping the earth fine and mellow among the plants. Stirring the soil can scarcely be repeated too often during the earlier periods of growth, or until there is danger of injury to the roots or to the tops of growing plants by the cultivator. The ground may be too wet, but never too dry, for stirring; because the more frequently it is broken up, fined and aërated, the more moisture will the soil absorb from the atmosphere. This is an operation that should be performed after every rain, sufficient to cause incrustation or baking, which would prevent a free admission of air into the soil. The most obvious benefit of stirring the soil is, the destruction of weeds; for no crop can become remunerative, if crowded by weeds which deprive it of air, light, moisture, and even a part of the fertility of the soil. A war of extermination should be waged against weeds, although at times they become a necessary evil to the farmer who only cultivates the soil between the rows. Breaking the lumps gives free scope to the finer roots to secure all the available nutriment within the extent of their ramifications, as these finer roots are not capable of penetrating large clods, and thus may be debarred from reaching a large part of the food contained in the soil. Thorough and frequent culture of the soil admits air to the rootlets of the growing plant; it increases the capillary attraction of the soil, by which its humidity is rendered more uniform; by presenting a larger number of points of radia-

tion, the deposit of dew, so beneficial in dry weather, is augmented; the temperature of the soil is increased by the freer admission of warm rain and air, and by the chemical processes thereby facilitated; and finally the fertility of the soil is augmented through the ammonia, nitric acid, etc., which are introduced with the air. The plow, horse-hoe, and cultivator are to be used, whenever available; but the hand-hoe must always be relied on for the finer and more careful work, when, particularly in the later stages of the crop, only superficial stirring is advisable. When plants are grown in a crowded state, darkness and want of air elongate the stems and leaves, at the expense of the roots and of a general healthy condition. The operations of thinning and hand-weeding are performed in connection with hoeing, to admit a free circulation of air around the remaining plants, and the sun is permitted to have an immediate influence upon each, developing the desired form, bulk, and other qualities.

CHAPTER III.

MANURES, THEIR KINDS AND USES.

Almost any soil may be so altered in its character by judicious and plentiful manuring, as to be made fertile enough to produce good and remunerative crops. Manure is the most indispensable factor for success in market-gardening, and must be applied in much larger quantities than in any other branch of agriculture. The gardener should never be restricted by a short supply to an inadequate application of manure, as the superior quality and quantity of his crops will generally justify an apparently lavish use. Knowledge of his soil, the peculiar requisites

of his crops, a judicious rotation, and his general experience will teach him, where and when he may economize with profit. He must not, however, gorge his land with manure, without rest or rotation, but seek to make it just rich enough to produce the most profitable crops. Should too much manure be applied, which, however, is rarely the case in vegetable culture, there will be loss of the most costly manurial ingredient—nitrogen. Location, or want of facilities and means, frequently confines the gardener to forced limits. Those who are neither conveniently located for the purchase of stable manure, nor own sufficient stock to secure from their droppings a sufficiency of barn-yard manure, must have recourse to manurial agents to be named hereafter. Astonishing results are frequently seen in gardens near large cities, from the readiness such localities offer for procuring the best manures.

Agriculture being the foundation of the prosperity of every people, and successful agriculture being impossible in the present condition of the earth's surface without fertilizers, it has properly been said, that "manure, even more than money, forms an integral part of a nation's wealth."

When civilized nations properly appreciate the value of all manurial substances (as they will when their territory becomes as densely populated as China), none of these, as at present, will be allowed to go to waste, and the productiveness of the earth, and with it the wealth of nations, will be enormously increased. Progress in this direction is being made. Scientific men have pointed out the sanitary and economical necessity of dealing properly with excrementitious manurial substances. If, during the past century, the night-soil of many of our cities had been incorporated in the surface soil of the surrounding country, instead of being buried under the houses of their citizens, what would be the fertility

of the soil, and what the probable benefit to the sanitary condition of the cities?

Manures are either organic or inorganic, according as they may owe their composition to the animate or inanimate world, or are derived from vegetable and animal matters of all kinds, or from minerals.

Every kind of matter which, when added to the soil, promotes the growth of a plant, whether by being itself directly taken up by its roots, or by chemically altering any heretofore existing constituent of the soil, so that it may be made available, or by physically altering its texture, may be considered a manure or fertilizer. Every plant consists principally of the gaseous elements, nitrogen, oxygen, and hydrogen, and of carbon in varying proportions, and smaller quantities of alkalies, earths, silica, sulphur, and phosphorus. Chemical analysis has enabled us to learn the exact proportions of the constituents of plants, as well as the composition of soils. If chemical forces were the only forces of nature concerned in the growth of plants, then by supplying the soil with exactly the constituents in definite quantities, which chemical analysis has shown it to lack for the full maturity of any given agricultural crop, rules and formulas could be devised, so as to insure regularly the maximum yields of all crops. But the changes, not yet fully understood, constantly going on within the soil and upon its surface in contact with the atmosphere; the mutual chemical reactions of the various soils and fertilizing materials, and the vital actions of plants, with their influence upon the soil in which they grow, perhaps even upon the surrounding air, still more inexplicable and wonderful, together with the contingencies of weather, render it impossible to formulate any such rules. Exclusive of the crushing effects of glaciers and other agencies, under the gradual influence of water and the atmosphere, the surface of the rocks have become sufficiently pulverized

and comminuted to support lichens and other of the lowest forms of vegetation, which, by their decay increased the film of soil. These were followed by plants of a higher organization, successive generations preparing for those which followed them. Thus organic constituents accumulated, until, in time, every arable soil contained in varying proportions every element of plant food. The variations are such, however, that a soil in its natural or original condition may be more or less deficient in one or other constituent, and therefore be better adapted for one crop than another. Finding from experience or analysis, which of the principal constituents is absent in a soil, we may supply it by the application of a special fertilizer for the production of a particular crop.

Humus, or vegetable matter undergoing decay, which gives the dark color to fertile soils, disintegrates mineral substances, supplies large quantities of carbonic acid, ammonia, and nitrates, and is indispensable to fertility; and yet the direct absorption of humic matters into plants is by no means so well established, as not to be a mooted question between the best chemical authorities and vegetable physiologists.

Ammonia and nitric acid have been shown to be present in the air; but it is generally held that the soil must absorb these, or they must be conveyed to it in rain water, before they can be generally appropriated by plants. Yet Peters and Sachs proved, experimentally, that a bean plant grew and flourished by direct absorption of ammonia through its foliage alone; but they failed with every plant but the bean, which, like our cow pea, is a leguminous plant. Chemical analysis shows that the leguminosæ are richer in nitrogenous matter than any other family of plants, and yet we know that our cow pea will grow on the poorest soil, deriving its nourishment in part from the atmosphere. Ozone, or active oxygen, is

emitted by plants, and the more abundant the foliage, the greater the quantity. By the action of this ozone, the nitrogen of the air may be converted into nitric acid. Perhaps the cow pea, the clover, etc., are more active in this respect than any other plants.

These preliminary observations bring me to the first and most simple and cheapest manner of conveying fertility to the soil.

GREEN MANURING.

As soon as life is extinct, all organic substances begin to decay, and the richer these substances are in albuminoids, or such as contain nitrogen, the better are they adapted for fertilizing, and the more rapid will be the process of decay. Under like circumstances, albuminoids of animal origin will decompose more rapidly than those of vegetable origin. All green succulent plants containing saccharine and mucilaginous matters and woody fibre, ferment readily, hence the advantage of plowing in green crops, whether of natural growth, or sown for the purpose. No plant is better adapted to be used at the South for restoring fertility by green manuring than our cow pea. The analyses here given show it to be rich in albuminoids; it makes in our climate a heavier growth than clover in any part of the world, and grows on soil much too poor for a fair crop of the latter, answering thus both the demands of quality and quantity. When plants are in flower, they contain the largest quantity of soluble matter; it is, therefore, when plowed under at this season, under ordinary circumstances, that they will afford the greatest amount of soluble nutritive matter.

In heavy, impervious soils, especially, they should not be turned under too deeply, or else the absence of air will retard decomposition. No applications of commercial fertilizers will continuously prove beneficial without the presence, in the soil, of decaying vegetable matter, or hu-

mus, and green manuring is the most efficacious and cheapest manner of supplying the land with large quantities of this necessary ingredient.

It should be practised by gardeners, irrespective of the supply of stable manure they may be able to command. But for those located at a distance from cities, and therefore not able to secure a sufficiency of barn-yard manure, green manuring becomes an absolute necessity.

It has been estimated that after the removal of a crop of clover and other plants, there remained in the soil, as shown in the following tables, a large amount of roots:

TABLE SHOWING THE QUANTITY OF ROOTS LEFT IN THE GROUND AFTER HARVESTING THE CROPS—ALSO THE AMOUNT OF NITROGEN AND ASH.

	No. of lbs. stubble and roots (dry) per acre to a depth of 10¼ inches.	*No. of lbs. of Nitrogen per acre.*	*No. of lbs. of Ash from Carbonic Acid, per acre.*
Lucerne	9,678.1	136.4	1,201.6
Red clover	8,921.6	191.6	1,919.9
Rye	5,264.6	65.3	1,747.8
Swedish clover	5,004.3	102.3	974.6
Oats	3,331.9	26.6	1,444.7
Lupine	3,520.9	62.2	550
Wheat	3,476	23.5	1,089.8
English peas	3,222.5	55.6	670.7
Serradella	3,120.1	64.8	545.6
Barley	1,991.4	22.8	391.1

ANALYSIS OF THE ASH OF THE ROOTS IN THE FOREGOING TABLE.

	Lime.	*Magnesia.*	*Potash.*	*Soda.*	*Sulphuric Acid.*	*Phosphoric Acid.*
Lucerne	197.7	24.2	36.7	26.4	18.7	38.5
Red clover	262.9	48.4	58.3	20.0	26.1	74.8
Rye	73.2	14.3	31.2	43.3	11.8	24.4
Swedish clover	136.1	17.6	25.9	5.7	13.2	24.2
Oats	85.5	11.2	24.8	18	8.8	29
Lupine	80.5	11.2	16.5	3.5	7	13.8
Wheat	76.7	10.1	28.4	11	7.4	11.8
English peas	71.7	11	11.2	7	9.4	14.3
Serradella	79.8	13.4	8.8	4 8	9	18.4
Barley	42.2	5.5	9.5	3.5	5.5	11.2

It will be seen by these two tables that the leguminous plants are especially rich in the three most important items: nitrogen, potash, and phosphoric acid.

These roots bring up from the subsoil plant food, and in decaying, tend to deepen the soil along their course. A crop of cow peas would probably have nearly as great a weight of roots as clover, and in the neighborhood of twenty tons of tops. The latter alone would contain one hundred and sixteen pounds of nitrogen, principally obtained from the atmosphere; or as much as is contained in twelve and nine-tenths tons of barn-yard manure, and directly applied to the soil. Seven pecks to two bushels of peas would cost from two dollars to three dollars, and the barn-yard manure, if at all attainable, nineteen dollars and thirty-five cents, applied to the land at one dollar and fifty cents per ton.

ANALYSIS OF GREEN COW PEA VINES.

This and the following two analyses were made by Prof. A. R. Le Doux, chemist to the State Board of Agriculture, of North Carolina.

Water	72.87	per cent.
Ash	2.00	"
Albuminoids	1.85	" containing ammonia, 0.35; nitrogen, 0.28
Cellulose	15.27	"
Fat	0.21	"
Carbohydrates	7.86	"

ANALYSIS OF THE ASH OF COW PEA VINES.

Ash	2.00	per cent.
Potash	14.80	"
Soda	23.29	"
Magnesia	6.74	"
Lime	22.57	"
Phosphoric acid	9.28	"
Sulphuric acid	2.35	"
Silica	1.08	"
Chlorine	0.19	"
Oxide of iron	a trace	"
Carbonic acid	19.70	"

By reducing the analyses to weights and measures it is found that

ONE TON OF FRESH COW PEA VINES CONTAIN

Water	1456.20	lbs.	
Potash	5.92	"	
Soda	9.32	"	
Magnesia	2.70	"	
Lime	9.02	"	
Phosphoric acid	3.72	"	
Sulphuric acid	0.94	"	
Silica	0.42	"	
Chlorine	0.08	"	
Carbonic acid	7.88	"	
Albuminoids	37.00	"	containing ammonia, 7.12 lbs.
Cellulose	305.40	"	
Fat	4.20	"	
Carbohydrates	156.20	"	
	2000.00	lbs.	

Boussingault found that snow, which had lain for thirty-six hours on the soil of a garden, contained ten times as much ammonia as the snow of the same fall from a contiguous stone terrace immediately after falling, the mulch of snow having interrupted the ammoniacal emanations from the soil. The ammonia of the soil is constantly undergoing change, and fluctuating in quantity. This most important article of plant food, and most expensive, when applied artificially, is most abundantly absorbed by the soil in summer from the atmosphere, and being conveyed to it by rains and dews, and continually being taken up by vegetation, it is volatilized, evaporated with water, washed away and lost. Later and more exact chemical experiments have shown that the soil contains less ready-formed ammonia than was formerly held to be the case.

Ammonia in dry soil.

Very light sandy soil from birch forest	0.00077	per cent.
Rich lime soil from beech forest	0.00087	" "
Sandy loam, forest soil	0.00012	" "
Forest soil	0.00080	" "
Meadow soil, red sandy loam	0.00027	" "
Average	0.00056	" "

It should be remembered that ammonia is only half as heavy as air.

Rich alluvial soils with decaying vegetable matter contain ten times as much, and fertilized field soils still more. Ammonia is only found in the surface soil, and generally at a depth of six feet there is no trace of it.

Sir J. B. Lawes found that in one year the drain water took nitrogen from a field bare of vegetation at the rate of forty pounds per acre; from a field of wheat, which after the harvest contained no weeds, twenty-five pounds, and from a field upon which grass seed had been sown with the wheat, and continued to grow on the stubble field, only five pounds.

POUNDS OF NITROGEN WASHED AWAY PER ACRE.

From soil without vegetation..... 40 pounds.
From soil with wheat, 15 pounds retained by crop... 25 "
From soil and grasses, 15 pounds retained by wheat.
25 pounds retained by grasses..... 5 "

He found that the drain water was much richer in ammonia than the rain water which fell upon the field. He also found another fact of importance to our subject of green-manuring, that the drain water carried away more ammonia in the fall than in any other part of the year. It is therefore exactly at this season that the soil of the truck-farmer should be covered by a dense growth of vines. It has been shown that even a perfectly inert body, like a board, lying upon the surface will improve the fertility of the soil, by preventing evaporation.

Now the mulch of pea vines acts like the covering of snow. It shades the soil from the rays of the sun, by which the volatile elements of fertility are exhausted with the vaporized water; it keeps the soil moist, mellow, and of even temperature; and as a secondary matter prevents the growth of troublesome weeds. The friable, unbaked condition of the surface, as has been before stated, is an element of fertility, by facilitating the absorption of fertilizing gases from the atmosphere. Under this dense covering, so retentive of moisture, the carbonic acid disintegrates particles of the soil and prepares it for plant

food; while in the darkness and under the shelter from winds, nitrates are formed and absorbed. It will be seen that the increase of fertility is greater than could be expected from all the manurial agents in the pea vines.

Clay soils, being more retentive of moisture and possessed of greater power of absorption, are less benefited by the mulch than those of a sandy character.

Like the questions of deep and shallow plowing and deep and surface manuring, that of plowing under the green vines, or allowing them to dry and partly rot upon the surface, will depend upon circumstances. They will contain and convey to the soil in the green state a greater quantity of fertilizing material and will decompose more rapidly. If intended to benefit a crop to be put in soon after they have reached a proper stage of growth, they must, of course, be plowed under green. Four weeks should elapse between turning under the vines and sowing or planting the crop, in order to allow a sufficient time for the most active decomposition to have passed, lest the heat evolved by the great mass of decaying green vegetable matter might be detrimental. For a spring crop, however, the vines should be left to die, and mulch the soil throughout the winter, unless indeed a second green crop, as of rye, is contemplated; because a bare fallow would be wasteful of the fertility supplied by the pea vines. It is an error that the bare soil deteriorates during summer only, for it is a common experience that a field of light soil, left bare after a late crop of sweet potatoes, shows a want of fertility the ensuing spring.

Two crops of pea vines may be grown in a season; but after an interval of three or four weeks. To turn under a heavy growth properly, it must first be pressed down by a field roller or by dragging over it a heavy harrow with the teeth turned up; and it requires a good two-horse plow with a large sharp revolving coulter attached. To draw the vines into the furrows, a heavy chain with suf-

ficient slack should be attached to the whiffletree and plow-beam. Capt. J. W. McAlpine has devised an iron hook "horn," which is attached to the plow-beam, as in figure

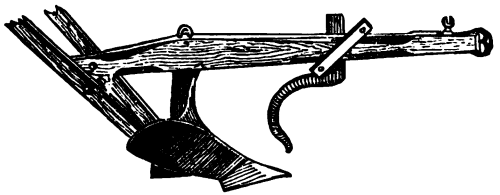


Fig. 1.—IRON HOOK OR "HORN" ATTACHED TO PLOW.

1. It works just in advance of the plow point; and on the surface its curvature corresponds to that of the mould-board, and draws the vines into the furrow. The same person has also invented a roller, which has a set of five projecting knives, with which to cut the vines when the growth is very luxuriant. By driving twice over the field at right angles the vines are cut in ten-inch lengths, and can be turned under effectively. The roller is fixed to shafts or a tongue, and as it is too light, a weighted

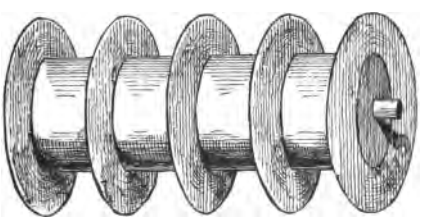


Fig. 2.—ROLLER FOR CUTTING COW PEA VINES.

box is attached above the axle. The roller, figure 2, is fourteen inches in diameter, the knives five inches wide and ten inches apart. As neither of these inventions is patented, any one can use them.

STABLE MANURE.

Stable manure is a complete fertilizer, and is of all the most to be relied upon by the market-gardener, as it

contains all the elements of fertility in available condition. No other is so well adapted to alter the physical condition of heavy soils, nor, when well rotted, better suits those of a sandy nature; nor is any other more apt to render the constituents of the soil available as plant food. Gardeners in the vicinity of cities may procure a sufficient supply and require no other manure, unless for a special purpose they desire to supplement it with a commercial fertilizer more rich in nitrogenous matter, such as Peruvian guano, fish scrap, etc. Those who are not so fortunately situated must utilize their smaller stock, by letting it form the basis of compost heaps to bring about and sustain the fermentation so necessary to break down the crude vegetable materials of which such heaps partly consist. Manures, to be promptly efficacious, should be in a state of at least partial decomposition, so that the elements of which they consist may be in a fit state to form new combinations, or act at once as plant food. To bring about this condition without waste of material and expense of time and labor, is one of the problems of the horticulturist. Once placed within reach of the absorptive power of the soil, there is no further loss by evaporation. If the manure pile could be merely kept sufficiently moist by rains, to prevent a too rapid fermentation, it might be advisable not to keep it under cover; but the rains in our climate are too often heavy enough to leach out valuable soluble parts of the largest heaps. The difference in the composition of covered and uncovered barn-yard manure is here shown.

Barn-yard manure.	*Covered.*	*Uncovered.*
Nitrogen equal to ammonia, per cent....	2.37	1.7
Organic matter soluble in water.....	6.42	1.82
Phosphoric acid.....	0.30	0.26
Alkalies.....	2.00	0.80

Exposed to the weather, piled, turned and handled, without proper judgment and close attention, there is

danger of loss, besides the expense of time and labor. The general agriculturist, particularly on heavy soils, whose crops are of slower growth, may apply manure green or fresh from the stables, when its effects are often so permanent as to be perceptible for many years; but the market-gardener's aim is to produce early crops of vegetables, and his manures must be in a readily available condition. He wants no permanent manures. Permanence and insolubility are, in this case, synonymous. Luxuriant growth is an indication of the solubility of his fertilizers. He wants his manure pile to undergo such an amount of slow fermentation, as to break down the coarse fibrous vegetable matter it contains, so as to admit its being readily cut with a spade, and thus also to reduce its bulk.

COMPOSITION OF FRESH AND DECOMPOSED STABLE MANURE.

	Water.	Organic Matter.	Mineral Matter or Ash.	Nitrogen in Organic Matter.	INGREDIENTS OF ASH.							
					Potash.	Soda.	Lime.	Magnesia	Phosphoric Acid.	Sulphuric Acid.	Silicate and Sand.	Chlorine and Fluorine.
Stable Manure.....	710	246	44.1	4.5	5.2	1.5	5.7	1.4	2.1	1.2	12.5	1.5
do. moderately rotted..	750	192	58.0	5.0	6.3	1.9	7.0	1.8	2.6	1.6	16.8	1.9
do. thoroughly rotted..	790	145	65.0	5.8	5.0	1.3	8.8	1.8	3.0	1.3	17.0	1.6

If piled so loosely as to admit air freely and be sufficiently moist, it will undergo fermentation so rapidly as to heat or firefang, and large quantities of the valuable, volatile carbonate of ammonia will evaporate, and the manure be rendered comparatively valueless. To avoid this too rapid fermentation, the pile may be broken down and turned whenever it begins to heat, until the process ceases to be too active. The escape of ammonia may be checked by mixing land plaster (sulphate of lime) with each load, so as to fix the ammonia as a sulphate (which is not volatile). The gardener near the

city, whose large pile daily receives considerable accessions, may resort to packing it so tightly as to limit the access of air, and consequently the rapidity of fermentation, until near planting time, or, if possible and better still, he may keep it too moist for rapid decay by adding night-soil from the city, which will at the same time improve its quality.

Gardeners near cities who accumulate a large stock of stable manure, do not generally place it under shelter, notwithstanding the accruing loss, but deposit it in suitable quantities for each field in a single pile, upon the headland convenient for use, and compact it by merely driving across the pile at each delivery. Never more than four hundred wagon loads are deposited in a pile. If, when finished, the heaps were covered completely with soil to the thickness of two or three inches, the escaping ammonia would be absorbed and fermentation retarded. It must be borne in mind, that even in winter we must limit the process of fermentation, and not encourage it, as is sometimes necessary in the Northern States; and we must also avoid leaching.

The fermentation of stable manure may be retarded by the admixture of substances not liable to rapid fermentation. The gardener in the country may resort to composting it with muck, woods-earth, or even good garden soil, dry and pulverized salt-mud, or the same material in the shape of a soft mush in order to avoid getting it in the form of large lumps into his manure, and may also use green marsh-grass (*Spartina stricta*), if he be located on "the salts." Vegetable refuse of every kind, with leaves from the woods, slops from the kitchen and wash-house, with the dung of those domestic animals which does not readily heat, as that of neat cattle and swine, in short, everything available that will supply plant food may be added to the heap. The dung of all kinds of poultry, the urine and night-soil of the farm,

scraps of leather and woolen cloth and waste feathers will heat; but they also should go into the compost-heap.

In the application of manure, the kind of crop, previous fertility of the soil and the quality of the manure will govern the quantity.

The amount and manurial value of the excrement voided by an animal depends upon the quality of its feed. The manurial value of hulled cotton-seed meal is more than twelve times that of wheat-straw, three times that of clover-hay, twice that of wheat-bran, ten times that of mangel wurzel, and thirty times that of common turnips. Of all vegetable substances used as cattle feed, hulled cotton-seed meal is the richest in nitrogen, phosphoric acid and potash, the most essential requisites in the growth of plants, and these will appear again most abundantly in the dung. The money value of the manure from different articles of food according to calculations of Sir J. B. Lawes, based upon the value of nitrogen, phosphoric acid and potash in leading commercial fertilizers, are:

VALUE OF A TON OF MANURE FROM DIFFERENT KINDS OF FOOD.

	Per ton.
Cotton-seed meal	$27.86
Linseed cake	19.72
Beans	15.73
Wheat-bran	14.59
Clover-hay	9.64
Indian meal	6.63
Oat-straw	2.90
Turnips	0.80

Block estimated that a horse fed on one hundred pounds of hay will void one hundred and seventy-two pounds of fresh dung; one hundred pounds of oats gave two hundred and four pounds; and one hundred pounds of grass gave forty-three pounds of dung. A horse furnishes, if well fed, about twelve thousand pounds of solid dung and three thousand pounds of urine annually. The manure from the street-car stables in New York was found

by Johnson to contain 0.53 per cent. of nitrogen. Reckoning two-thirds of the solid and fluid droppings saved, we have ten thousand pounds, or five tons of manure to each horse, containing fifty-three pounds of nitrogen.

In his method of applying his manure the sensible gardener will be governed by the nature of his soil and manure, and by the kind of crop he wishes to grow.

Half an inch of rain, although amounting to fourteen thousand gallons, or fifty-six tons to the acre, would not penetrate deeply into a heavy soil, hence in such a soil long, partly unfermented dung would not, if buried deeply, find sufficient moisture and air to support fermentation and dissolve out the manure for the benefit of the crop. A sandy soil favors decomposition, being more permeable to air and moisture, and as roots penetrate more deeply in a light soil, unfermented dung might be placed five or six inches deep in such a soil. Upon a dry, hot, light soil, manure of that description would be too heating if near the surface. At the rate of eight tons of manure to the acre, half an inch of rain would furnish nearly a gallon to every pound, and in the case of well-rotted or soluble manure, placed near the surface of either heavy or sandy land, would convey the ingredients of plant food in a dissolved state to the roots of plants. On either heavy or sandy soil, therefore, well-rotted manure should be intimately mixed with the soil to the depth of three or four inches, when applied broadcast, and the nearer the surface, the finer should the soil be pulverized to increase its absorptive power. Unless unfermented long manure is buried in a light soil, it had better be not incorporated, but applied upon the soil as a mulch. Such manure commingled with a heavy soil would benefit it physically by rendering it more open for admission of air, and the heat evolved would accelerate growth. The observations above apply to land well-

drained, especially under-drained. If badly drained and presenting a slope in any direction, the washing surface-water would carry off a large part of the soluble manure from the surface.

Manure for close crops, whenever a large supply permits, should be applied broadcast, by preference; but generally economy and the desire for a vigorous start will demand its application in the drill. Only in the case of plants standing far apart, as melons, is manuring in the hill practicable, unless only a part of the manure is so applied. The great majority of the roots would soon extend beyond its limits, and the plant would suffer in the later stages of growth.

BARN-YARD MANURE.

This consists of the mixed droppings of such animals as are allowed to run in an open lot, the surface of which is strewn with more or less of absorbents. It may be regarded as a combination of the solid and fluid excrements of the different animals, and is of variable quality, owing to waste by leaching rains. If horses and mules alone are enclosed, its value would be that of an inferior stable manure. Notwithstanding its variable value, it is often used as a standard.

COW MANURE.

Although the fresh, solid excrement of the horse is richer in ammonia than that of neat cattle, the latter, on the other hand, is not subject to loss by heating. It contains more urea (supplying nitrogen) in the urine, and there is a greater quantity both of solid and liquid excrement voided; hence the manure of a cow must be considered more valuable than that of a horse, particularly when the former has had nutritious food.

A cow, fed upon twenty-four pounds of hay and twelve and a half pounds of Irish potatoes, voided daily about one bushel of solid excrement, containing two and a half pounds of salts of ammonia, potash, soda and lime.

The annual product of a cow is thirty-one thousand and twenty-five pounds of dung, of which four thousand eight hundred pounds is organic matter, containing:

189 lbs. ammonia,
71 lbs. phosphate of lime,
37 lbs. sulphate of lime,
77 lbs. carbonate of lime,
24 lbs. common salt,
15 lbs. sulphate potash.

The yard manure of a full-grown ox is considered equal to that of a horse and a half, or ten to fifteen sheep.

One cord fresh cow dung weighs		9,298	lbs.
One cubic foot of old, well-rotted ox manure weighs		58	"
" " " " fresh " " "		48	"
" " " " well-rotted stable manure		39	"
" " " " fresh " " "		30	"*

The amount of urine voided annually by a cow is from twelve thousand to fifteen thousand gallons.

In every hundred pounds:

Of cattle urine are	4.00	lbs. of	urea.
" horse urine	0.70	" "	"
" human urine	2.36	" "	"
" sheep urine	2·80	" "	"
" hog urine	5.64	" "	"†

The composition of urea is, according to Dr. Prout, carbon, 19.99; oxygen, 26.66; hydrogen, 6.66; nitrogen, 46.66. The nitrogen is equal to 56.66 parts of ammonia. Owing to the non-heating character of cow manure, it is well adapted to sandy land; and in consequence of the smaller quantity of vegetable matter to undergo fermentation, it has not the physically beneficial effects upon heavy lands. The value of cow-penning land and its permanent effects (sometimes noticeable for twenty or

* Dana's Muck Manual.
† Dana's Muck Manual.

more years) is probably owing to the fact that none of the urine is lost. On light sandy land it is serviceable through the treading and compacting of the soil.

The absence of cut-worms on land recently cow-penned is probably attributable to the mulch of dung and the consequent absence of vegetation in the late summer, and not to the urine, as is generally supposed. When a gardener owns a number of neat cattle, and is located conveniently on the salt marshes, he can collect a quantity of good manure, particularly well-suited to his sandy land, by penning his stock upon alternate layers of salt-mud and green marsh-grass.

ANALYSES OF MARSH-GRASS, OAT-STRAW AND MEADOW HAY. COMPARATIVE MONEY VALUE; HAY BEING ONE DOLLAR FOR THE SAME WEIGHT:

	ORGANIC SUBSTANCE.						
	Total.	*Digestible.*	*Albuminoid.*	*Carbohydrates.*	*Fats.*	*Ratio of digestible Albuminoids to Carbohydrates.*	*Money value Hay $1.00.*
Salt marsh grass.....	73.7	39.7	2.2	36.7	0.8	1:176	$0.68
Oat straw	81.7	39.9	1.3	37.4	0.6	1:299	0.62
Meadow hay.....	79.5	47.4	5.4	41.1	0.9	1:79	1.00

Barn-yard manure taken as a standard of comparison, the weights opposite the manures below show the number of pounds which would be equal in effect to one hundred pounds of the former:

Barn-yard manure..				100
Solid excrements of the			cow	125
Solid	"	"	horse	73
Liquid	"	"	cow	91
Liquid	"	"	horse	16
Mixed	"	"	cow	98
Mixed	"	"	horse	54
Mixed	"	"	sheep	36
Mixed	"	"	hog	64

MANURE OF HOGS.

The urine of man and that of the hog contain phosphates, of which that of the ox and horse is destitute.

The pig voids a larger quantity of urine than any other domestic animal The manure from fattening hogs is very valuable, but it contains a peculiar volatile substance which gives to roots and bulbs to which it is applied a disagreeable taste. Hog-pens should be liberally supplied with absorbents.

SHEEP MANURE

contains less vegetable fibre than that of cattle, and may be classed with hog manure; but the nitrogenous matter being more abundant, it is a heating manure when piled and moistened. If penned, one sheep can manure ten and a half feet square in a night. It is too rich in ammonia to be allowed to come in direct contact with seeds or the roots of plants, and should be composted or mixed with the soil.

POULTRY MANURE.

The dung of all domestic fowls and birds generally has marked manurial properties on account of the large amounts of ammonia and phosphate it contains. Like sheep manure, Peruvian guano and all other fertilizers rich in ammonia, it should not, in its fresh, undiluted state, be permitted to come in immediate contact with the roots of plants, nor with the seed. The floors of the poultry-houses should be strown with finely powdered muck or woods-earth and land plaster, to fix the ammonia and to purify the atmosphere. Subsequently the manure should be composted before being applied to the field.

PERUVIAN GUANO.

The Peruvian, the other South American and the African guanos being the accumulated dung of sea-birds which

subsisted upon fish, contain considerable quantities of phosphate of lime from the bones, and ammonia from the flesh of the fish. According to the quantity of rain in the climate whence they are obtained, the amount of ammonia will vary. Their value depends principally upon the quantity of ammonia, which already exists, or may be formed by their further decomposition. Next to ammonia, the soluble phosphoric acid is the most valuable constituent, and after this potash is next in importance. Guano from the Chincha Islands contained from fifteen to twenty per cent. of ammonia; but notwithstanding the exhaustion of the entire supply, and that the guanos from other sources, as the Guanape, are poorer in ammonia, and contain more of the less valuable constituents, Peruvian guano retails at the former price.

Proprietors of city stables make no provision to save the most valuable portion of the droppings of their stock—the urine—and gardeners near cities supplement their stable manure with strong, soluble commercial ammoniacal fertilizers, by which, in a measure, they do away with the necessity of completely fermenting it. Truck farmers in the vicinity of Savannah now prefer the highly ammoniated commercial fertilizers, to the inferior Peruvian guano on the market, both for side dressing, and for supplementing their stable manure. Gardeners need not be chemists, but they need to profit by the teachings of the chemist, or be swindled by dishonest manipulators of the article upon which their success depends. The gardener who purchases an artificial fertilizer should know what element his land or crop requires. The law enacts that each package of a fertilizer shall be accompanied by a chemical analysis of its contents. The Agricultural Department of Georgia has published a tariff of values of the important ingredients in fertilizers, by means of which any one may calculate the approximate agricultural value per ton of any such fertilizer. (See Appendix.) These

values are not exact. The result of their use depends upon too many contingencies. These trade values are based upon the value of the ingredients in a fertilizer of assured merit.

COMMERCIAL FERTILIZERS.

Appreciating the great importance to Southern agriculturists, that they should make no indiscriminate and wasteful use of commercial fertilizers, nor be swindled by the knavery of dishonest manipulators, I enumerate below the conclusions, as advice, of one better able to tender it than myself.

Prof. Atwater, of the Connecticut Experimental Station, reaches the following conclusions with respect to the use of artificial fertilizers:

First.—Soils vary widely in their capacities for supplying crops with food, and consequently in their demand for fertilizers.

Second.—Some soils will give good returns for manuring; others, without previous amendment, by draining, irrigation, tillage, or use of lime, marl, etc., will not.

Third.—Farmers cannot afford to use commercial fertilizers at random, and it is time they understood the reason why.

Fourth.—The right materials in the right places, bring large profits. Artificial fertilizers, rightly used, must prove among the most potent means for the restoration of our agriculture.

Fifth.—The only way to find what a soil wants, is to study it by careful observation and experiments.

Sixth.—Success in farming, as in other business, requires the use of brains.

The controversy between the advocates of home-made manure and of artificial fertilizers may be reduced to the following rules:

First.—No land will remain fertile for a long number of years, if continuously manured with a special fertilizer alone, but will require a rotation of manures, as well as of crops.

Second.—Land, to respond properly to artificial fertilizers, must be well stored with vegetable matter.

Third.—After the gardener has accumulated as large a pile of home-made manure as possible, by raking and scraping into his compost heap every article fit for plant-food within his reach, let him supplement it with all the artificial fertilizers of the best quality (for he cannot afford to pay freight on sand and water, and other adulterations) that it needs, and that he can use upon his crops with profit.

COTTON SEED.

The chemical analysis of cotton seed shows it to be the most concentrated and nutritious cattle-food known; and experience has corroborated the fact. It is considered injurious to hogs. Cattle eliminate from it very little of the manurial elements, and their droppings, after the use of cotton seed as a food, as shown by Sir J. B. Lawes, form a manure of the best character. Their albuminoids are not as ready to undergo fermentation, and therefore the ammonia is not so quickly available, as those of animal substances; it is therefore necessary that they shall have been fermented. If the truck-farmer be at the same time a cotton planter, or be located where he can conveniently procure cotton seed cheaply, he needs no other strong supplement to his manure pile. Should he desire to increase its efficacy for a special crop, an addition of forty or fifty pounds of a good potash salt, or four hundred or five hundred pounds of an acid phosphate per ton of the compost, would answer the purpose, if the cotton seed was about equal in weight to the former. It is too rich to feed alone, and should be consid-

erably mixed with poorer food, as straw, shucks, etc.; but if the vegetable-grower be a stock-owner, he should feed as much cotton seed, or cotton-seed meal, as possible, and save the droppings of the cattle. The best method of preparing cotton seed is to compost it with stable-manure, and prevent a too rapid fermentation.

No country is so fortunate as the South in possessing in its cotton seed, for a long number of years considered a mere waste product, the best cattle-food and one of the best fertilizers in the world. If correctly appreciated, only the oil, which has no manurial value, would be exported. While the stores of guanos are being exhausted, the quantity of cotton seed grows with the increasing cotton crops.

FISH SCRAP—FISH GUANO.

Moss-bunkers, or Menhaden (*Alosa menhaden*) are caught along the Atlantic Coast from Maine to Virginia, in immense numbers. The fish are boiled, and, after the extraction of the oil by compression, the more or less dried refuse, consisting of the flesh and bones, is sold under the above names as an exceedingly rich fertilizer. For the sandy coast lands, I have for years given it the preference over the best Peruvian guano, or any other commercial fertilizer. In a compost, it readily undergoes decomposition, changing rapidly into those compounds assimilable by plants. Placed alone in the soil, particularly in a dry season, it does not become sufficiently decomposed, to make the phosphoric acid of the bones available. This article is so useful in supplying the manufacturers and manipulators of artificial fertilizers with the most valuable ingredients of many of their compounds, and is by them so well appreciated, that notwithstanding the enormous quantities produced by the fisheries, it has been difficult to procure it of late years.

Along the coast of Florida large quantities of fish offal may be made available.

NIGHT-SOIL.

Like other animal manures, night-soil varies in efficacy and composition in proportion to the richness of the food from whence it was derived. It is more nutritive than the dung of animals; but owing to the large quantity of water with which it is diluted, and its offensiveness, it is difficult of transportation.

In so far as nitrogen, phosphoric acid, and potash are concerned, human excrements compare with the average of excrements of horses, cows, sheep, and swine, as shown in the following table:*

ONE TON (2,000 POUNDS).	SOLIDS.			URINE.		
	Nitrogen.	*Phosphoric Acid.*	*Potash.*	*Nitrogen.*	*Phosphoric Acid.*	*Potash.*
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Human	20.0	21.8	5.0	12.0	3.7	4.0
Mean of horse, cow, sheep, and swine	9.4	6.2	4.3	22.5	0.4	25.4

One ton of the fresh, solid excrement, contains more than twice as much nitrogen as a ton of fresh mixed animal dung; the urine of man contains nine times as much phosphoric acid as that of horses, etc., and probably nearly all the nitrogen is in available condition.

Lawes and Gilbert found that an adult male voided in the course of a year, fæces, ninety-five pounds; urine, one thousand and forty-nine pounds, or one thousand one hundred and forty-four pounds of excrement in the pure state.

* Harris's Talks on Manures.

These contain:

Dry substance.....	fæces,	23¼	lbs.;	urine,	34¼	lbs.;	total,	58¼	lbs.
Mineral matter.....	"	2¼	"	"	12	"	"	14¼	"
Carbon.....	"	10	"	"	12	"	"	22	"
Nitrogen.....	"	1.2	"	"	10.8	"	"	12	"
Phosphoric acid.....	"	0.7	"	"	1.93	"	"	2.63	"
Potash.....	"	0.24	"	"	2.01	"	"	2.25	"

One hundred pounds of the dry substance of the fæces contain five pounds of nitrogen and five and one-half pounds of phosphates. One hundred pounds of the dry matter of urine contains twenty-seven pounds of nitrogen, and ten and three-fourths pounds of phosphates. City night-soil should be promptly incorporated with stable manure upon its arrival, and that of the farm should be mixed with dry, fine muck, woods-earth, or garden soil, by which the ammonia will be absorbed and its offensiveness avoided. This muck, or earth, when dried, may be repeatedly used for the same purpose. Should the quantity be deficient, a little plaster might be added.

In the earth closets, the dry earth, before using, contained in five tons, sixteen and seven-tenths pounds of nitrogen; after being used

Once.....5	tons of	dry	earth	contained	24.0	lbs.	nitrogen
Twice.....5	"	"	"		36.3	"	"
Three times 5	"	"	"		44.6	"	"
Four times..5	"	"	"		54.0	"	"
Five times..5	"	"	"		61.4	"	"
Six times....5	"	"	"		71.6	"	" *

Owing to its great solubility, night-soil is especially adapted to growing early vegetables. The commercial fertilizer, poudrette, is night-soil, which has been dried in pans, and mixed with charred earth, peat, charcoal, or ground peat and plaster. It is variable in quality in proportion to the care with which the escape of ammonia may have been prevented; the best, compared with cow-

* Dr. Gilbert.

dung, in respect to the quantity of ammonia being rated as four to one.

MUCK.

When successive generations of plants have grown and, with the leaves from surrounding forest trees, have decayed on the same low, swampy soil, the vegetable matter increases so rapidly that, with the exception of that supplied by the decaying mass, very little mineral matter is mixed with it. The mud from the bottom of a pond, in or around which no plants grow, consists merely of the washings from the higher ground, and deposits from the water, and must be of inferior quality. It is evident that muck must be very variable in quality, according to its origin. The best, besides imparting valuable humus to the soil, contains four per cent., or even more, of nitrogen. In some instances, on the sea coast, a rich deposit may be subject to overflow at spring tides, which, receding, leave marine animals that will further enrich it. An application to plants of such muck alone, imparts the dark green color to the leaves so indicative of ammonia. It should be dug and be permitted to dry out several months before being used, or it may be mixed with lime at the rate of three or four bushels to the ton of muck. There is no better absorbent for the earth closet, the poultry house, the stable, the cow pen, or the manure pile than salt-marsh muck. It may be drilled in with any artificial fertilizer. Woods-earth, or leaf mould, is still better as decayed vegetable matter, and as a source of humus.

SUPERPHOSPHATE OR ACID PHOSPHATE OF LIME.

Phosphoric acid is, next to ammonia, or the nitrates, the most important element of plant food, and it is also, next to nitrogen, the earliest to become exhausted in soil. It exists in all plants, in most soils, combined with

vegetable matter, in all excrementitious matter, and in the tissues and bones of animals. Bones consist of phosphate of lime, or bone earth and gelatine.

Phosphoric acid and lime unite in three different proportions. In common bone earth there are three equivalents of lime to one of phosphoric acid, and this salt of lime is called the tricalcic phosphate, or three-lime phosphate. This is not soluble in pure rain water. Large bones, as is well known, remain for ages buried in the ground, and are only very slowly dissolved by the carbonic acid in the water. The next is the reverted, or dicalcic, or two-lime phosphate, consisting of two equivalents of lime to one of phosphoric acid, which is also insoluble. The monocalcic, or one-lime phosphate, consists of one equivalent of lime and one of phosphoric acid, and is the acid-phosphate, or superphosphate of lime of the agriculturist, and is soluble in water.

The manufacturer is enabled to present this valuable soluble fertilizer to agriculture by treating bones, or the South Carolina phosphates, the poor phosphatic guanos, the coprolites, or any other mineral tricalcic phosphate of lime, with sulphuric acid, or oil of vitriol. This removes two equivalents of lime (as plaster or sulphate of lime), converting it into the one-lime, or superphosphate.

The surest source of phosphoric acid is finely-powdered bone meal. One ton of this contains, in its gelatine, as much nitogen as eight and one-half tons of fresh stable manure, and twenty-three per cent. of it is phosphoric acid. Bone meal is slowly soluble in the soil by the action of carbonic acid. For vegetable growing it should be decomposed in the manure pile, and supplied at the rate of five hundred pounds to the acre.

The manufacturer mixes finely-powdered fish-scrap, nitrate of soda, or some other more or less nitrogenous substance with his superphosphate, and produces his "ammoniated superphosphate." This mere manipula-

tion the gardener may undertake more cheaply at home, and with greater satisfaction.

Phosphatic fertilizers are especially beneficial to root and bulb crops.

More or less of the insoluble phosphates may be mixed with and sold in the superphosphate. These have little practical value to the general agriculturist, and none to the gardener.

During the fermentation of the bone meal in the manure pile, which is accelerated by the gelatine, soluble nitrogenous organic compounds and salts of ammonia are produced. These act quickly and powerfully as fertilizing agents, and render the phosphate more soluble.

POTASH.

No vegetable can grow without potash, for it is a constituent of every plant. Its presence has been proved to be necessary for the formation of starch in the leaves; and the experiments of Lawes and Gilbert have pointed out that it aids leguminous plants, like clover, in assimilating nitrogen, which they contain so largely. It results in soils from the disintegration of minerals, and is less apt to be absent, particularly in heavy soils, than either nitrogen or phosphoric acid.

Neither the land of the truck-farmer near a city, nor any other land, which has been, even only moderately, enriched with the dung of domestic animals and accompanying vegetable matter, needs any special application of potash. If a crop, even of potatoes, fails on such soils, it will be owing either to a deficiency of the more important elements of plant food, or to other unfavorable contingencies, as of weather, tillage, drainage, etc,, rather than to a lack of potash. But on light lands frequently manured with exclusively nitrogenous manures, like fish scrap, Peruvian guano, etc., and cropped with potatoes, or some

other vegetable exhaustive of potash, an application of a salt of potash either alone, or of a fertilizer largely containing it, becomes indispensable. All potash salts, being exceedingly soluble, are liable to be leached out of sandy land. A crop of one hundred and fifty bushels of Irish potatoes will remove from the soil, in the tubers, 51.3 lbs. of potash, 1.44 lbs. of phosphoric acid, and 30.6 lbs. of nitrogen. Formerly the ashes of hard-woods was nearly the only, and limited source of potash; but recently the kainit mines in North Germany, near Stassfurt and Leopoldshall, provide this element in enormous quantities. The lower grades contain a constituent, the chloride of magnesium, which is actually injurious to plant growth. Years ago, like J. H. H. Gregory of Marblehead, Mass., I had an experience which showed the detrimental effects of this salt in the ruin of a potato crop. Mr. Gregory mixed a compost of twenty-eight bbls. of hen manure, twenty-eight bbls. of dry, rich soil, twelve bbls. of fine ground bone with three bbls. of kainit. This was allowed to heat twice before it was applied, at the rate of two quarts to the hill, and according to his custom, cabbage seed was sown in the field, on each hill. The seed sprouted; but the little seedlings were killed as soon as the first rootlets reached the fertilizer. As large quantities of this kainit are being introduced into the South, statements by Prof. Atwater (American Agriculturist, Vol. XXXVI, No. 11) are here given as a warning against the improper or indiscriminate use of the lower grades of these potash salts: "The mines at Stassfurt, Leopoldshall and Westeregeln are from six hundred to one thousand two hundred feet deep, and the area of deposit is calculated at six hundred square miles. The salts, as taken from the mines, contain only a small proportion of potassium compounds, the bulk consisting of materials which have comparatively little agricultural value, and are sometimes positively injurious. They are, therefore, subjected to

chemical treatment, by which the potash compounds are more or less completely purified. As prepared for market, the potash fertilizers contain potassium in the form of either chloride of potassium, or sulphate of potash, and, along with these, other compounds, as shown by the following figures from circulars of the German manufacturers:

COMPOSITION OF THE GERMAN POTASH SALTS.

BRANDS OF POTASH SALTS.	POTASSIUM AND OTHER COMPOUNDS.—LBS. IN 100 LBS.					
	Sulphate of Potash.	*Chloride of Potassium.*	*Sulphate of Magnesia.*	*Chloride of Magnesium.*	*Chloride of Sodium.*	*Actual Potash in Potassium Compounds.*
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1. Crude kainit	17–26		10–12	14–17	32–40	9–14
2. Crude sulphate of potash (dung salt)	18–22		16–20	2–4	35–50	9–12
3. Prepared kainit	24		16–18	2–4	36–42	13
4. Crude sulphate of potash—magnesia	29–33		17–22	3–5	30–35	15–18
5. Five-fold concentrated salt (chloride)		80–85	1–2		12–16	50–52
6. Purified sulphate of potash	70		5–10		5–10	38
7. Purified sulphate of potash	90–95		3–6		1–2	50–52
8. Purified sulphate of potash—magnesia	54–57		34–38		1–2	28–30

"All these brands contain other than potash compounds. Of these the sulphate of magnesia may be valuable, since it is useful as plant food, and further, aids in diffusing the potash through the soil and thus bringing it within reach of the roots of plants. The chloride of sodium, or common salt, though not needed for plant food, is useful in rendering other materials available, and hence is often quite valuable as a fertilizer. For certain crops, however, like potatoes, sugar beets, and tobacco, it is apt to be detrimental; probably on account of the chlorine which it contains. The chloride of magnesium may be injurious. Nos. 1, 2, 3, and 4, in the table, are low grade articles, furnishing only nine to eighteen per cent. of actual potash. The crude kainit, No. 1, is the ma-

terial as dug from the mines and ground. The prepared kainit, No. 3, is made by roasting the crude kainit. The 'dung salt' No. 2, is a waste product, formed in the manufacture of the high grade articles. Nos. 5, 6, 7, and 8, are high grade articles of two kinds, viz., the chlorides or 'muriates.' In No. 5, the potassium is combined with chlorine, as chloride of potassium, or 'muriate of potash,' and in the sulphates, Nos. 6, 7, 8, it is combined with sulphuric acid, as sulphate of potash. Little of No. 8 is manufactured.

"It is becoming customary to characterize these salts by the percentages of sulphate or chloride of potassium they furnish. Thus an 'eighty per cent. sulphate' is one that contains eighty lbs. of sulphate of potash in one hundred lbs. of the salt. An 'eighty per cent. muriate' would contain eighty per cent. of chloride of potassium.

MOST DESIRABLE GRADES FOR OUR USE.

"It is clear that for this side of the Atlantic, the high grades must be the most economical as potash fertilizers. The sulphates are, on the whole, preferable; but the potassium in these is more costly than in the chlorides. The chlorides sometimes injure the burning quality of the tobacco leaf, decrease the amount of sugar in sugar beets, and of starch in potatoes, and make the latter less 'mealy' than is desirable. The sulphates, on the other hand, are always safe. For buckwheat, corn, wheat, oats, and other grains, for leguminous crops and grasses, and for wet soils, the chlorides are preferable because cheaper. Generally speaking, the most desirable grades will probably be:

"*For sulphates:* the highest grades which contain from seventy-five to ninety per cent. or more, of sulphate of potash, corresponding to from forty to fifty per cent. of actual potash.

"*For chlorides:* the 'muriate' with eighty to eighty-five per cent. of chloride of potassium, corresponding to fifty to fifty-three per cent. of potash.

"By the above table, the amount of actual potash in the low grade salts, varies from nine to eighteen per cent. Some of the salts sold in this country have yielded as low as seven to eight per cent. The disadvantage in purchasing these poorer articles is a double one. Not only do they furnish very little potash, the bulk being made up of other and inferior or injurious compounds; but the purchaser has to pay the cost of freight and handling of this extra material between the mines in Germany and his farm.

"The method of applying potash salts is of great importance. Cases are common,—I have known several myself, where crops were injured or destroyed."

Professor Atwater proceeds to recommend that the salt be uniformly diffused through the soil, and not concentrated in single spots, that it be applied in the fall for the next season's crop, so that the rains may have an opportunity to distribute it through the soil; or that it be composted with muck, farm refuse, or earth. Doubtless the chloride of magnesium could thus be rendered harmless.

In another volume of the "American Agriculturist," Prof. Atwater says: "Analyses of potash salts by Prof. Johnson, chemist of the Connecticut Board of Agriculture, and by Prof. Goessmann, State Inspector of Fertilizers in Massachusetts, agree entirely with Prof. Storer's, and ours, in showing that a large amount of the German potash salts imported into this country are of the poorer grades. This is a 'serious evil, which needs to be known—and to be corrected.' As long as farmers will buy low-priced potash salts, and other fertilizers, because they are 'cheap,' and pay no regard to the actual quality, they must expect to get poor wares at dear rates, and have poor success in using them."

Ashes are the product of combustion, and in their effect are somewhat similar to that of decaying and moulding vegetable matter. When the use of potash is indicated, and ashes of hard-wood can be obtained, they are a safer and much more satisfactory and effective fertilizer than the German potash salts; for they contain all the mineral elements of plant food which the tree had derived from the soil. They are, of course, void of nitrogen; but tend to render nitrogen and other soil ingredients available. They also amend the physical condition of heavy soils, and are adapted to those of sandy character. Measures should be devised to save the ashes of cities as manure. A bushel of unleached ashes weighs about forty-eight pounds; a "struck" bushel of leached ashes, fifty-seven pounds, and one "heaped," about seventy-one pounds. A dressing of fifty bushels of unleached ashes to the acre, at forty-eight pounds to the bushel, would give two hundred pounds of potash; seven hundred and sixty-eight pounds of lime; one hundred and twenty pounds of magnesia; forty-eight pounds of phosphoric acid, and thirty-six pounds of sulphuric acid.

Wood Ashes, 100 lbs. contain on the average	*Potash, lbs.*	*Lime, lbs.*	*Magnesia, lbs.*	*Phosphoric Acid, lbs.*	*Sulphuric Acid, lbs.*
Unleached.....	7 to 10	32	5	2	1½
Leached	1 to 2	25	3½	1½	⅛

QUICK-LIME.

Ammonia is not produced in organic matter until putrefaction commences, when nitrogen and hydrogen combine in the proportions of one to three to form it.

If quick-lime is added before the process begins, the lime unites with the nitric acid, and forms nitrate of lime, fixing or retaining the nitrogen; but when the lime is added to stable manure in fermentation, or to Peruvian guano, or to ground fish-scrap, or to any other substance containing ammonia, the ammonia escapes into the air,

and is lost. We may see this take place, if we heat decaying vegetable matter with lime, or witness it if we mix guano and quick-lime together in the palm of the hand, and smell the escaping ammoniacal gas. A good soil may, without any recent manuring, contain three thousand or more pounds of nitrogen per acre in the first six inches of depth, or as much as is contained in three hundred and thirty-three tons of fresh horse manure, and yet require a fresh application of soluble nitrogenous manure to bring a satisfactory crop to maturity. The reason is, that the above large amount of nitrogen is locked up in the soil, existing in unassimilable combinations, in short, is unavailable. Professor Johnson found only sixty-three pounds of available nitrogen in four thousand six hundred and fifty-two pounds of a soil per acre, at the depth of twelve inches.

Every arable soil contains a sufficiency of lime for the direct needs, as plant food, of any crop; and while the cereals, or grain plants, contain less of lime, both in grain and straw, than any other crop, they especially require nitrogenous manure, and to these the general agriculturist applies it freely. Now, a simple dressing of lime has been known to double the yield of grain on a soil containing unavailable nitrogen.

It would require too much space to mention the chemical changes lime undergoes from its condition as carbonate of lime in rock or shells, until, as caustic lime, it exerts its strange power, or to attempt an explanation of its extraordinary effects, not yet fully understood, upon the various constituents of the soil.

Suffice it to say: First.—It renders stores of wealth in the soil available to crops. Second.—It neutralizes acids in the soil which might be injurious to vegetation. Third.—It rapidly decomposes vegetable matter in the soil, and renders its elements fit for plant food. Fourth.—It amends the physical texture both of heavy clays and

sandy land. Fifth.—It aids and promotes the production of nitric acid, and forms the soluble nitrate of lime. Sixth.—It hastens the maturity of crops. Seventh.—It is supposed to form combinations in the soil which attract nitrogen from the atmosphere—probably silicate of lime.

Notwithstanding all these advantages the truck-farmer will rarely have recourse to lime. Near the city his large supply of manure will render its use unnecessary. Only in case of an emergency, an unexpected lack of manure, and on heavy land, would he be warranted in bringing out the latent power of his soil by a heavy application. Small quantities might be desirable occasionally. Its use must impoverish the soil to the extent of its decomposition, and, if persisted in, the complete removal of organic matter and of ammonia; and the gardener who farms with less stable-dung, or near the coast, rarely gets a sufficiency of vegetable matter incorporated with his sandy soil.

> "Lime and lime without manure
> Will make both land and farmer poor."

Neither lime nor ashes should ever be mixed with dung, Peruvian guano, poultry manure, or any other organic fertilizer upon the soil, unless there be present sufficient muck or earth to arrest and absorb the escaping ammonia.

Lime is applied at the rate of from twenty-five to two hundred bushels per acre. One hundred bushels would add about one half of one per cent. to a soil six inches deep.

COMMON SALT.

Chlorine and soda are more or less the constituents of every plant. Salt (chloride of sodium) is a combination of chlorine and the metal sodium. Soda is a compound of oxygen and sodium. Common salt is the source of the

soda compounds. Every soil, and every animal and vegetable manure, contain this salt, and generally in sufficient quantity for the direct needs of most plants. Storms may blow the salt-spray of the ocean fifty miles inland. The coast lands, the Gulf and Atlantic shores, of Florida, must be abundantly supplied with it to meet the direct wants of a crop.

Plants which naturally live upon the sea shore, like asparagus, generally abound in salt, while in others it may exist as a mere trace. In beets it forms nearly one-third of the ash; in potatoes seven, and in carrots six per cent. In all roots it is generally a prominent constituent. Plants will therefore respond differently to its application. While an asparagus bed will bear a heavy dressing, the same quantity would destroy most other cultivated plants as effectually as it does the weeds among the asparagus plants. It needs therefore to be used carefully, five or six bushels to the acre being enough, to be applied either broadcast, if fine, or in compost, if coarse. It increases the brightness and strength of the straw, and the yield of grain in the cereals. Its effects on fertile soil, already supplied with a sufficiency for the use of the crop, demonstrates the fact that it exerts an influence upon other fertilizing agents, decomposing them and rendering them available. The moisture it attracts from the atmosphere through its hygroscopic power must also be a great benefit to sandy soil.

GYPSUM—LAND PLASTER.

This, which is the sulphate of lime, can supply plants with sulphuric acid and lime; both of which, however, are generally found in soils in sufficient quantity for the needs of most crops. Where clover may be grown as a green manure or for feed, it is a useful fertilizer; but otherwise the market-gardener will rarely use it, unless he incorporates it in his manure pile to fix the

ammonia as sulphate. Where the potato-rot prevailed, gypsum has been known to show worse results than any other application; probably owing to the moisture it attracted from the atmosphere.

NITRATE OF SODA AND THE AMMONIA SALTS.

These are the most concentrated nitrogenous fertilizers, and in their pure state are to be sparingly and carefully applied, so as not to come in direct contact either with seed or the roots of plants. To increase the strength of stable manure, particularly such as is deficient in liquid excrement, or of compost, there is nothing better than these salts, to be added to the former just before its application. They may also be carefully sown broadcast at the rate of one-fourth to one-half a ton, intimately mixed with fine muck, woods-earth, or soil, to insure an even distribution. The best to use will be such as supply the gardener with nitrogen at the cheapest rate. The following table presents the present market prices, their proportion of ammonia, and their calculated value, according to the now existing high valuation of ammonia in fertilizers—twenty-five cents per pound:

	Nitrogen.	*Equivalent to Ammonia.*	*Calculated Value.*
Nitrate of soda	16.40	19.20	$96.00
Nitrate of potash	13.75	16.6	83.00
Carbonate of ammonia	17.70	21.50	107.50
Muriate of ammonia	25.50	31.00	155.00
Sulphate of ammonia	21.20	25.75	128.60

It must be borne in mind, however, that these salts are not chemically pure, but contain about ten per cent. of impurities, which may or may not have any agricultural value.

In nitrates of soda and potash, the nitrogen exists in the available form of nitric acid, but is more apt to be lost by leaching than the ammonia in the other salts.

The carbonate has too high a value as a drug to allow it to be used by the gardener, except perhaps on a very small scale, and experimentally in the green-house. For such crops as are grown for their leaves, as cabbage and spinach, these salts are admirably adapted; but in the case of potatoes, large doses, as the physician would say, are contra-indicated.

LIQUID MANURE.

In China and Holland, liquid manuring for the most valuable crops is extensively practised. As the urine of all animals is much richer than the solid excrements (that of the horse containing thirty-one pounds of nitrogen to the ton, whereas the solid excreta only contain nine pounds), it has a relatively higher agricultural value, and should be saved with care proportioned to its efficacy. The nitrogen being in a more available form, if applied to crops in the liquid state, it will be more valuable in consequence of its solubility. When plants have reached the stage of rapid and steady growth, approaching maturity, their vital energy and the absorptive power of their roots will enable them to profit wonderfully from an application of liquid manure, for which reason the cauliflower and the cabbage are treated to food in this form just before the former is expected to "curd," and the latter to head.

When seedling plants have to be watered at the time of transplanting, a weak liquid manure would help them to start better than pure water.

Urine is too "strong" to be allowed to come in direct contact with seed or with roots, and should first be allowed to ferment, and then be diluted with five or six parts of water. In its fresh state it contains no ammonia, this being formed from urea after putrefaction has commenced.

Solid manure may be steeped in water until the latter

has assumed a dark clear color, when the liquor may be used, or Peruvian guano, at the rate of a quarter pound, or any of the ammonia salts, at the rate of two ounces dissolved in a gallon of water, may be substituted. Liquid manure should be applied just before a rain; at any rate, the soil should be moist, as there is then no danger of the liquid passing through the soil and beyond the reach of the roots. One gallon of water is capable of absorbing one thousand one hundred and fifty gallons of gaseous ammonia. Owing to its inconvenience, truck-farmers rarely use liquid manure.

CHAPTER IV.

THE ROTATION OF CROPS.

It is as advantageous for the market-gardener as for the general agriculturist to grow his different crops in succession. Various theories have been proposed to explain the phenomena attending the growth of certain crops on the same soil for a number of successive years.

Chemical analysis shows that, while all plants are composed of nearly the same elements, they exist in each kind in varying proportions. It is supposed that a plant requiring for its full development more of one inorganic element than another, exhausted the soil of the former to a greater or less degree, and rendered that gradually unfit for its own continued growth, while a different plant, somewhat differently constituted, would still find in the soil all the elements it required for its maturity in sufficient quantity, and in an available condition.

When it was ascertained that, if all the elements known to be taken from the soil by a certain crop, were returned to it in fertilizers, and even more of these than it had lost, the crop still continued to depreciate, the theory of exhaustion of the soil then failed to be a satisfactory solu-

tion. De Candolle and others then supposed that the necessity for a rotation of crops was attributable to the fact that plants, during growth, throw off excrementitious matters by their roots, which, they agreed, were injurious to a following crop of their own kind, but not to others. Exceptional cases, as that of the onion, would have to be accounted for upon the hypothesis that that plant either did not excrete from the root, or if it did, the matter eliminated was not detrimental to itself. Others supposed that the decaying fibrous roots might be injurious. Whether or not either of these theories alone correctly explains the phenomena of rotation, the practice of rotation remains the best possible method of keeping the soil clean, mellow, and in the best attainable condition for the production of remunerative crops with the least cost of manure.

It is doubtless true here, as in many other matters pertaining to agriculture, that circumstances may, to a certain extent, modify a general rule. In the treatment of land of different kinds and textures the farmer should be an empiric as little as the physician. The fact that rotation may, for a limited number of years, be unnecessary on deep alluvial soils, or on heavy clays, with, or without manure, may not suffice to upset a general practice as old as agriculture itself.

Joseph Harris in his "Talks on Manures," while discussing the results of the interesting experiments of Lawes and Gilbert on the heavy clay soil of "Rothamsted," and probably basing his observations too upon experience with his own clays, says: "The old notion that there is any real chemical necessity for a rotation of crops is unfounded. Wheat can be grown after wheat, and barley after barley, and corn after corn, provided we use the necessary manures, and get the soil clean and in the right mechanical condition." In other parts of his valuable book he says: "A light sandy soil will not pre-

serve manure like a clay soil."—(p. 177.) "On light sandy soil, such an annual dressing of manure (fourteen tons barn-yard manure per acre) would, in the course of a few years, make the land too rich for wheat."—(p. 176.) "On sandy land, the manure will decompose more rapidly, and act quicker than on clayey or loamy land."—(p. 295.) "To what, then, is the power of soils to arrest ammonia, potash, magnesia, phosphoric acid, etc., owing? The above experiments lead to the conclusion that it is due to the clay which they contain. Pure sand was found not to possess it."—(p. 218.) "A London clay contained about seven thousand pounds of ammonia per acre, equivalent to the quantity contained in seven hundred tons of barn-yard manure."—(p. 221.) "Clay mixed with manure arrests, or checks decomposition. Sand has no such effect. If anything, it favors a more active decomposition, and hence, manure acts much more rapidly on sandy land than on clay land."—(p. 268.)

A table by Lawes and Gilbert shows the produce of wheat per acre on the clay soil of Rothamsted for twenty consecutive years without any manure:

SEASON.	*Year.*	*Bushels.*	*Pecks.*
First	1843	15	
Second	1844	23	0½
Third	1845	17	3½
Fourth	1846	16	3½
Fifth	1847	14	
Sixth	1848	19	1
Seventh	1849	15	3½
Eighth	1850	15	3½
Ninth	1851	13	3½
Tenth	1852	5	3½
Eleventh	1853	21	½
Twelfth	1854	17	
Thirteenth	1855	14	2
Fourteenth	1856	19	3½
Fifteenth	1857	18	
Sixteenth	1858	18	1½
Seventeenth	1859	12	3½
Eighteenth	1860	11	1½
Nineteenth	1861	16	
Twentieth	1862	17	1

The weight of the grain of the first crop was fifty-eight and five-tenths pounds per bushel, and that of the twentieth, or last, was sixty-two and seven-tenths pounds per bushel, so that after continuous cropping, without manure, the land produced in the twentieth year two and one-fourth bushels more per acre, and the wheat weighed four and one-fifth pounds more per bushel than the first season.

Can there be a doubt that on any other than a heavy clay soil the results of these experiments would have been different? Is there a soil on the southern sea coast, void of clay, which, after continuous cropping for twenty years without manure, would produce more oats or rye (wheat requires clay) or any other crop, to the acre, than it would the first season? If so, to what is the exhaustion of our cotton plantations to be attributed? Better farming, or cotton seed, cow peas and rotation might have preserved their fertility.

Neither the areas, nor the varieties of crops of the truck-farmer are sufficient to enable him always to practice regular courses of rotation; nor should a lack of manure ever compel their strict observance, but he should aim:

First.—To have a crop which succeeds another as dissimilar in composition and the demands it makes upon the soil as possible.

Second.—Never to have plants of the same family succeed each other. For instance, melons should not follow cucumbers; tomatoes should not follow egg-plants, or Irish potatoes; beans should not succeed peas, or *vice versa.*

Third.—Tuberous plants should not be allowed to follow plants of the same character.

Fourth.—Roots should not succeed to root crops, as turnips, beets, etc.

Fifth.—Deep or tap-rooted plants should succeed others of dissimilar growth.

Sixth.—To make the heaviest applications of manure to such crops as require most, as cabbage, onions, etc; and have other crops succeed those requiring less, as tomatoes, egg-plants, etc., so that the whole farm may be gradually brought to the same degree of fertility.

As the crops of the truck-farmer come in for shipment during spring and early summer, there is rarely an opportunity of having a second crop occupy the same ground, before the first is harvested; still it may occur. Thus a crop of melons or cucumbers may be put in between the wide rows of peas. The latter will be off before the former requires the first working.

A further benefit of successive rotation and continued cropping is the destruction of noxious weeds, and of such insects as prey for more than one season on the roots of a particular kind of crop, by depriving them of their food.

A continued liberal use of the same fertilizer, although it be the complete stable-manure, will eventually show less favorable results, than when manures are alternated. Owing to a too limited use, this will not frequently happen on our truck-farms; but it may occasionally occur near cities, where, after a series of heavy manurings with stable-manure or night-soil, the land seems to crave something else. A resort in such a case to a good commercial fertilizer will remedy the evil and increase the crop.

CHAPTER V.

WEEDS.

Plants, according to their manner of growth, are either exogenous (outside growers), their bulk being augmented by layers next to the inner bark; or endogenous (inside growers), which increase from the centre, the new growth pressing the older outwards.

All the trees of the United States, with the exception of the Palmetto, are outside growers. The Asparagus is an example of an inside grower.

The stem of an outside grower consists of the outer bark, the inner bark, or liber, the sapwood or alburnum, the heartwood and the pith. The medullary rays connect the pith horizontally with the inner bark through the wood.

When a seed germinates, it sends its radicle down into the ground and its sprout (plumule) up into the air. The root obtains from the soil crude sap, containing solutions of gases, earths, and salts, which ascend through the sapwood to the leaves. Leaves may be considered a continuation of young bark, and in plants, which are naturally leafless, the young bark performs their office. Leaves are provided on their upper and lower surfaces with breathing pores, or stomata; and those plants growing in moist and shady places, are most abundantly supplied with them, and the pores are of larger size. The outer skin, or epidermis, of thick-leaved plants growing in hot, arid situations, like the aloe, the prickly pear, and the purslane, have few and small breathing pores, and the skin is still further protected by a waxy covering. When the sap reaches the wide expanse of surface of the leaves, it comes in contact with air, heat, and light, the crude sap is digested and the excess of water

is evaporated through the breathing pores, mainly of the upperside of the foliage. Leaves absorb gases, and under some circumstances moisture, from the atmosphere through the stomata of their lower surface. It is not necessary to discuss the chemical changes brought about in the leaves, my object being merely to demonstrate their great importance, and to show that whatever tends to injure their health and vigor, tends to destroy the plant.

The digested sap, made available through the action of the leaves for the support of the plant, descends and distributes its nourishment wherever it may be needed in the interior of the plant. A plant, constantly deprived of its leaves, could no more continue to live, than an animal devoid of skin with which to perspire, lungs with which to breathe, and stomach with which to digest, and there is no exception to this rule, which applies alike to endogens as exogens. Therefore any weed may be destroyed, if frequently hoed down, and some may be killed if cut down only once.

The crops of the truck-farmer, however, should be kept so well stirred that most of the weeds with which he has to contend are killed before they appear above the ground. Two of our worst weeds, the Wormseed (*Chenopodium ambrosioides*, var. *anthelminticum*), and Dogfennel (*Eupatorium fœniculaceum*) must be eradicated when young, or they will become troublesome by sprouting from the deep roots. Even our worst pest,

NUT-GRASS—COCO-GRASS (*Cyperus rotundus*, var. *Hydra*),

can be destroyed, if constantly hoed, or plowed and raked out, but owing to the depth of its growth and to the abundance of nuts, each of which has several eyes, to clear any considerable area by hoeing, would cost more than the land would be worth. If a piece of land over-

run with nut-grass is to be cleared and will grow cow peas, these should be sown at the rate of two and a half bushels to the acre, as soon in the spring as possible, and be plowed under before the shedding of the leaves admits any light and air to the soil. These should be followed by a second crop of peas, and the latter by one of rye. If this round is repeated, there will be little, if any, nut-grass to be seen at the commencement of the third season, but a third year may be required to kill it. If a mulch is laid upon the ground six or eight inches, or more, in thickness, nut-grass will push its way through; but the stems upon which the young nuts are formed will not penetrate the earth deeply; and, if the mulch has partly rotted in contact with the soil, they will remain upon the surface, or so near it, as to be destroyed to a great extent, by firing the covering material during dry weather. A second or even a third mulch may be necessary to be completely effective. Nut-grass is propagated by the nuts; and if the growth above ground is constantly interrupted, and it is not allowed to bloom, it is doubtful whether the nuts can come to maturity.

BERMUDA GRASS (*Cynodon Dactylon*)

may be destroyed in the same manner as nut-grass; but an easier and cheaper method may be adopted with this plant, as it may be killed out by repeatedly plowing and raking during hot and dry weather, particularly in heavy ground with clay subsoil. Neither this nor the nut-grass matures seed in the United States.

PURSLANE (*Portulaca oleracea.*)

This weed spreads an extraordinary number of fine seeds over a place, if allowed to mature, and it should be destroyed when young. Owing to the nature of the leaf and the paucity of stomata, this plant may be upon the sur-

face for days in the hot sun without dying. The same is true, but to a greater degree, of

THE PRICKLY PEAR (*Opuntia vulgaris,*)

which is occasionally an annoyance on high grounds near the coast, and on the Sea Islands. It must be dug up and removed from the land. It will require a hot wood fire to kill it.

CHAPTER VI.

SEED AND SEED SOWING.

Every seed is provided with an embryo, the vitality of which remains dormant so long as the carbon which the seed contains is not eliminated, by forming carbonic acid with oxygen during the process of germination. The composition of a seed is less liable to vary than that of any other part of a plant.

One of the most wonderful works of nature is the provision made for the perpetuation of the species, whether of animals or vegetables. Every seed germ, or embryo, is really a plant in miniature, having its stem and leaves in a more or less undeveloped state.

If kept dry and excluded from air and its oxygen, the duration of its vitality differs with various seeds. If the seed of any given plant, which ordinarily retains its vitality for an extended period, is, when fully matured, thoroughly dried, and perfectly protected from contact with air and moisture, there is no reason why it may not retain its vitality for many years. Prof. Lindley says: "Not to speak of the doubtful instances of seeds taken

from the pyramids having germinated, melon seeds have been known to grow at the age of forty years, kidney beans at one hundred, sensitive-plant at sixty, rye at forty, and there are now (1859) growing, in the garden of the Horticultural Society, raspberry plants raised from seeds sixteen hundred or seventeen hundred years old."

There is considerable difference of opinion between experimenters in regard to the duration of vitality in agricultural seeds under ordinary climatic influences; but it probably depends upon the comparative condition of the seed and the influence of the different climates of their respective countries. The table below shows the earlier experiments of Cobbett in England, and the later ones of Vilmorin in France.

	Cobbett. Years.	*Vilmorin. Years.*		*Cobbett. Years.*	*Vilmorin. Years.*
Artichokes	3	5	Kale	4	5
Asparagus	4	4	Leek	2	2
Bean	2	6	Lettuce	3	5
Bean (Kidney)	1	3	Melon	10	5
Beet	10	5	Onion	2	2
Broccoli	4	5	Okra	2	–
Cabbage	4	5	Pea	2	4
Carrot	1	4	Pumpkin	10	5
Cauliflower	4	5	Radish	4	5
Celery	10	–	Salsify	2	2
Corn	3	2	Spinach	4	5
Cucumber	10	5	Squash	10	5
Egg-plant	3	–	Tomato	2	5
Endive	4	9	Turnip	4	5

Southern vegetable-growers must bear in mind that our warmer climate, particularly on the moist sea coast, will affect the longevity of seed. Onion seed, for instance, cannot be relied upon after the first year; those of the varieties of cabbage and of turnip after the second, and those of cucurbitaceæ, as melon, squash, cucumber, etc., after the fourth year. Some seeds lose their germinating power, if allowed to become dry, as will those of the willow two weeks after ripening. Experience teaches us that fresh seeds of cucumbers, melons, etc., produce plants

that are likely to run to vine, while older seed yield more abundant crops of fruit. Some English horticulturists carry the cucumber seed they intend to plant in hot-beds, in the pockets of their pantaloons for months prior to planting, in the belief that the warmth of their bodies increases the productiveness of the vines. However this may be, it is a safe rule that seed should be fresh. Old seeds, endowed with weaker vitality, are slower to germinate; they come up irregularly, and too large a percentage is absolutely sterile. Seed of ten-weeks stock, four years old, is used by gardeners to produce plants to bear double flowers, while fresh seed produces the more perfect single flowers. Such being the case, only fresh tomato seed should be used; as the double flowers produce irregularly-shaped, knobby fruit, while it is only the single flowers that form the desirable round and smooth fruit.

The chemical elements in an imperfectly matured seed seem unstably combined. If such germinate at all, it will be sooner than seeds fully ripe; but the plants will be of weaker growth, owing, probably, to an insufficient storage of nourishment. Such unripe seeds will also be the earliest to become sterile. Some vegetable physiologists believe that immature seeds will produce earlier varieties than the mature. There are many facts in regard to the distribution and germination of seeds, which appear unaccountable and wonderful. After the destruction of forests by fire, certain plants will spring up in large numbers, although no parent plants of the same species may have been growing in the vicinity. The unavoidable conclusion is, that the seed had remained in the soil for years, awaiting favorable conditions for its development. Plants, unlike any in the vicinity, have grown in the soil excavated from deep wells; thus the upper crust of the earth seems full of seeds. Every Southern farmer, who has cleared land,

knows that a growth of oak or other deciduous trees will follow pine, and vice versa. It seems as if nature would thus demonstrate the principle of rotation of crops. Theory seems to be unable to explain how seeds can remain dormant in the soil for years, under conditions apparently favorable to germination.

THE QUALITY OF SEEDS.—TESTING.

Its plumpness, its specific gravity or density, rather than its size, is an indication of the quality of a seed; and it will generally sink in water. No one matter is of more importance to the horticulturist, than the quality of the seed he sows, not only in reference to the certainty of vegetating, but also to its being true to variety. Our well-known seed merchants, as a general rule, doubtless seek to send out sound and reliable seed; but they are compelled in some instances to depend for a supply of special kinds upon seed-growers personally unknown to them, and may themselves be deceived. In an experience of twenty-six years I have found, however, a considerable difference in the comparative trustworthiness of some of the leading and most extensive seed dealers. A few of the smaller firms, and of less extended reputation, frequently gain the custom of Southern druggists, and often of retail dealers, by granting the privilege of returning the stock which remains unsold in their hands after the spring sales. In some instances such seeds may be good and true; but having suffered losses from their use, I warn Southern growers against their purchase.

The surest way to avoid disaster is to make a preliminary test of any suspicious seed. It is not necessary to commit the seed to the ground. Dr. Nobbe, of the Tharand, Saxony, Seed Control Station, has devised a simple apparatus of earthenware for the purpose. To test seeds, I place a sample, folded in a piece of moist cloth, or blotting paper, at the bottom of a small com-

mon flower-pot, which is plunged in the soil of another, one or two sizes larger, and a third pot, filled with earth, of the size of the first is placed within the second. If the soil of the two pots is kept damp, the seed, if good, will germinate, and can, from time to time, be conveniently examined. By thus testing his seed, the gardener may ascertain the percentage, sure, under proper management, to come up, and may regulate his sowing accordingly.

If seeds are to be preserved and retain their proper vitality, it is indispensable that they should be completely ripe, and be kept perfectly dry. They should be inclosed in cloth bags, and suspended in a dry room. Imported seed should not, as is frequently done, be sent to our warm climate packed in hermetically-closed metallic cases. Neither the seed, nor the thick paper generally used in packing being sufficiently dry, the confined moisture will cause a commencement of germination, and the heat generated by the process, and the moisture, is very apt in such cases to destroy the vitality of all.

Seeds of home growth that are subject to injury from weevils may be preserved in jugs, demijohns, etc., in which a piece of gum camphor, a little cyanide of potassium (a most deadly poison), or an open phial of turpentine has been inserted.

THE GERMINATION OF SEEDS.

As the absence of moisture, warmth and air is necessary to the preservation of the vitality of seed, so the presence of these agents is essential to excite their vital forces, and cause germination. In this process the outer covering of the seed softens, and allows the embryo to swell; water is decomposed, and the carbon forms carbonic acid with its oxygen. In the case of sterile seed the softening and swelling occur without any de-

composition of water. In the presence of a superabundance of moisture, fresh seeds may absorb more water than they are able to decompose, and the death and subsequent rotting of the germs take place; for this reason it is more advisable to sow in dry than in wet weather.

The degree of heat necessary to start vital action varies in different species, and depends upon their character and composition, and the climate to which the plants were indigenous.

The most favorable temperature of the soil for the germination of seeds of plants from cold climates, may be stated at from fifty degrees to fifty-five degrees; for those of green-house plants, at from sixty to sixty-five degrees, and for those of the torrid zone, at from seventy to eighty degrees.

Of all the seeds sown by the truck-farmer, those of the onion will germinate at the lowest temperature; other conditions being favorable, they will sprout at a few degrees above freezing, while those of the melon and egg-plant require a higher temperature. Healthy seeds of some species may be exposed to a remarkably high degree of temperature without impairing their vitality. Seeds of raspberry have been known to grow which had been picked from a jar of jam which must have been heated to the degree of boiling syrup, or two hundred and thirty degrees.

To promote germination, seeds are sometimes soaked in water heated to within a few degrees of the boiling point, or about two hundred degrees, but this is only practicable with hard and healthy seed. The practice of soaking seeds in water to soften the outside covering, or in an alkaline solution having a strong affinity for carbonic acid, or a substance able to supply a large quantity of oxygen, like a dilute solution of oxalic acid, is only advisable when the difference of a few days in the time of germination is important, as for instance, in the case of

the loss of a previous planting by frost; otherwise it is better for the gardener to commit his seed to the ground under as favorable conditions as possible, and trust to the usual natural process.

HOME-GROWN SEEDS.

While it is a matter of true economy for the farmer to purchase as little as he may, and sell as much as he can, a non-observance of which rule has often been the fault of the Southern planter; we are compelled by the effects of our climate to purchase the majority of our vegetable seeds of either foreign or Northern growers. Half the success of growing profitable crops depends upon the seeds, and we can better afford to pay treble the price for those which, from experience, we know to be good and true, than to grow them ourselves, and find too late that they are worse than useless. Again, many vexations from buying poor seed may be avoided by growing such as are indigenous to warm climates, and may be produced cheaply and of superior quality. There is no reason, for instance, why the Southern truck-farmer should not save his own seed of melons, squashes, cucumbers, onions, pepper, tomatoes, and egg-plants, provided he can keep each of the first named three far enough apart from any other species of the squash family to prevent mixing, while it is not advisable for him to use his own seed of cabbage, cauliflower, etc.; of beets, carrots, turnips, etc.; for the former will run prematurely to seed without forming heads, and the roots of the latter will be of inferior quality, becoming small and woody. It is so difficult to preserve large quantities of garden peas and snap beans against injury from weevils, from the time they mature, through the summer, to the following spring, that, although I have seen peas of home growth satisfactorily tested along side of those grown in Canada, both in ref-

erence to earliness and productiveness, I would not advise the saving of these.

Plants like the sugar cane, the sweet and Irish potato, which have been propagated exclusively for years from cuttings or tubers, cease bearing matured seed. The potato does occasionally produce seed; but more frequently at the North than at the South. Should seed of Southern production be desired for the creation of new varieties, it might be possible to induce some of the late, not very productive, varieties to perfect seed by preventing the plants from bearing tubers, by their removal while small. This will encourage the flow of nutritive matter to other parts, just as contrarywise, the removal of flowers will increase the size of tubers.

CAUSES OF FAILURE.

If, after a seed is consigned to the soil, the changes which it undergoes during germination proceed without interruption, the young plant will in due time make its appearance in a healthy state; but when severe changes in the state of the weather occur, it may perish. If all seeds sprouted as promptly and with as much vigor as those of the radish, there would be little uncertainty attending seed sowing; but many varieties, large and small, remain in the ground from a few days to several weeks, during which interval unpropitious changes of the weather may occur; a fall of temperature sufficient to destroy the barely sprouted seed below the surface may supervene; or the weather may become so wet as to rot the seed before germination has taken place; or the sun may heat the soil sufficiently to scorch the young sprouts at or above the surface; or, finally, the ground may become so baked by the sun after a rain, as to prevent smaller seed from breaking through the hard crust. In case of sowing small seeds, like carrot, celery, etc., which are slow to germinate in ground likely to bake, they may

be covered with mould or sand free from such tendency. Large seeds, possessed of more vigor, may be able, when germination has once commenced, to upheave a considerable weight of soil, and break through the crust. This baking of the soil is a most prolific cause of failure and disappointment.

None of the seeds of the truck-farmer need be sown broadcast, as drill sowing, either by hand or with a machine, is to be preferred. The seeds may be sown more regularly; the young plants may be thinned and weeded more conveniently, and the soil may be stirred between the rows. The drill distributes the seed more evenly, at a uniform depth, and the operation may be performed during the prevalence of high wind. There are a number of seed-drills now offered which do good work. Some of these are so arranged that they may be converted into hand-cultivators, and be used for weeding the crop after the plants are up.

No safe rule can be established, as to the depth at which different seeds should be sown, as the weather and varieties of soil must be considered. If continued damp weather could be assured, the rule to cover the seed to a depth equal to its own thickness, might be a safe one. In such case seeds would germinate, if merely laid upon the surface, although darkness is more favorable for the formation of carbonic acid, and therefore for germination. In this matter, the sower must in each instance be governed by the character of his seed, and by the conditions of weather and nature of soil which obtain at the time. While on heavy land, and during damp weather, a grain of corn would grow, if barely covered; in a dry climate and a very sandy soil, it might be necessary to place it one foot below the surface, as is sometimes the case in Colorado. Seed should never be sown, particularly on sandy soils, when the ground, from previous drouth, is very dry below, with the surface only moist

from recent rain; for if rain does not follow, the seeds may perish after germination has merely commenced; or the lower soil may be too dry a little later to supply the young root with sufficient moisture. Should soaked seed be sown under such conditions, in the hope of assisting germination, the dry soil may absorb the moisture from the swollen seed, and probably the vitality of all be destroyed. At whatever depth the seeds are sown, the soil should have been carefully broken up or "fined" before sowing, using the harrow, roller, and rake, as circumstances may require. After the seeds are sown, the surface should be rolled, in order to bring the soil in close contact with the seed. Where the seed-bed is small, the same end is accomplished, if the soil is "firmed" by patting it with the back of the spade. Mr. Henderson strongly advocates the use of the feet to bring the soil in contact with the seeds, or "treading in," as it is called. A person passes over the line of the drill, and tramps or presses the soil down with his feet. This is a method practised by some, but I have never seen that it had any advantage over the even pressure of the roller.

CHAPTER VII.

HOT-BEDS, COLD FRAMES, AND WEATHER.

Seneca and Pliny inform us, that the Romans attempted the forcing of vegetables by means of artificial heat, using thin plates of talc or mica in lieu of glass. As a rule, the first vegetables and fruit of a season bring the best prices, and the grower is prompted to use all available means to push forward his crops to early maturity. Florida, being more exempt from frosts than other States,

can place upon the market any vegetable that, in less favored sections, requires glass, earlier, more plentifully, and with less cost than the gardeners of more Northern States. Since Florida gardeners have taken up truck-growing for the Northern markets, those in the vicinity of Charleston and Savannah require less glass than formerly. Hot-beds are rarely required as far south as Charleston and Savannah to forward and protect tender seedlings, like tomatoes, egg-plants, peppers, etc. Cold frames, under proper management, not only suffice for this, but are preferable. When any animal or vegetable matters undergo rapid fermentation with partial admission of air and moisture, a considerable amount of heat is evolved, and the gardener takes advantage of this chemical process in his forcing operations. In the management of crops under glass, and the removal of young and tender plants to the open ground, his knowledge and observance of the changes of the weather will serve him better than in any of his other operations. In the vegetable kingdom, the heat of the sun is the cause of growth, and its light that of maturity. Animals may live with little or no light, but no vegetable can come to perfection without it. The sun's rays are both those of heat and light. Were it not for the wise prevention of the accumulation upon the earth of the heat received from the sun, all life upon our globe would be destroyed.

DEW AND FROST.

Evaporation and radiation of heat into space from the earth during the night, when it receives little in return, accomplish this purpose; and these means are the source of benefit. When the surface of the earth has, by this radiation of heat, become colder than the surrounding air, the moisture of the air is condensed upon it in the form of dew, as when moisture appears on the outside of a glass of ice-water, or upon a gun-barrel, etc., upon being

brought from the cold outside air into a warm room. The value of dew to vegetation is manifested in such dry rainless seasons, as those of 1880 and 1881. This moisture gathers where it is most needed, on low plants, the roots of which do not penetrate the earth deeply, and on foliage near the ground. The precipitation of moisture upon tender vegetation, must diminish the cold which occasioned it, and thus prevents the injury that might arise from that cause. The partial prevention of cold on an object near the ground, by the interposition of a screen between it and the sky, is due to the reflection of heat by the lower surface of the screen back to the object. This compensates in part for the loss by radiation.

The gardener avails himself of this, in protecting his plants in cold and clear nights by the interposition of screens, which are most effective when not in contact with the vegetation to be protected. Clouds similarly prevent injury from cold at night, by radiating heat to the earth in return for what they intercept from the earth. The lower the clouds the more effective they are. Fog, or clouds of smoke, have the same effect as clouds of vapor. Coast lands and islands, from their situation, are more subject to a cloudy sky, to movement in the air, and are therefore less exposed to cold by radiation; but the chief reason why islands are more temperate than continents and inland situations, is, that the water of the ocean, a little below the surface, is uniformly in all latitudes about 45°. Florida as a long peninsula, with an ocean east and west, and Bermuda, as evidenced by her extremely early crops, although lying in the same latitude as Savannah, enjoy these advantages in an eminent degree, besides having the warm waters of the Gulf Stream flowing near their coasts. The cooling of a body exposed on a clear night, depends in part upon the readiness with which it receives heat by conduction from bodies warmer than itself in contact with it.

Bodies thus exposed must radiate as much heat during a wind as in a calm, but in the former case the constant contact of warm air will return to them nearly as much heat by conduction, as they lose by radiation, and only a slight agitation of the air is sufficient to thus prevent dew and frost. The reason why depressed locations suffer most from cold by radiation is, that they are more becalmed; and there must also be less dew in them, because of the calm atmosphere which provides the moisture. It is true that at considerable altitudes the air becomes colder as the hight increases, but on hills, in cold and clear nights, the frosts are less severe in consequence of the movement in the atmosphere. The dew, which has been deposited upon vegetation by condensation from the atmosphere, will become hoar or white frost, when the object upon which it has settled is cooled by sufficient radiation to congeal the water into crystals of ice. This can only occur in this latitude up to 44° F. of the surrounding atmosphere; or in other words, frost is impossible, unless the thermometer falls as low as 44°.

The different effects of the several solar rays are yet imperfectly understood; but there is no doubt that the heating and illuminating rays produce different results. Plants supplied with heat and moisture may grow for a short time in darkness; but there will be no development of chlorophyll, or leaf-green, and they cannot thrive. Plants, in all stages of growth, need the presence of atmospheric air, from the seed requiring oxygen for its germination, to the plant which acquires its chief supply of carbon from the air. Water is absolutely necessary in the economy of vegetation.

The management of plants under glass, whether they are to be transferred to the open ground or not, requires an acquaintance with the effects of these various agents and phenomena, so that they may be made to harmonize in the production of a sturdy and healthy vegetation.

If a relative excess of either is permitted, failure is certain. A spindling growth will result from too much light or heat; too luxuriant growth from an excess of moisture and heat; and the plants are apt to damp off from much moisture and deficient light.

Having succeeded in producing satisfactory plants, it is the policy of the gardener to transfer them to the field as early in the spring as possible.

IMPORTANCE OF WEATHER OBSERVATIONS.

The study of atmospheric changes has in all ages been pursued by men engaged in agriculture and the pasturage of animals. To put out his plants judiciously, the gardener must carefully observe the general season. The belief in any direct effect of the moon upon vegetation, is a mere superstition of the past. At full moon the reflected light amounts to $^{1}/_{619000}$ of the sun's brightness, not equal in intensity to that reflected by a white cloud in a summer's day; and the heat at the same phase reaches only $^{94}/_{1000000}$ of a degree. It is now generally denied that the moon has any effect upon the weather; yet observations extending through many years seem to warrant the belief that changes of the weather do more frequently occur at the moon's phases than at any other time.* At any rate during fair weather radiation is most active in consequence of the clear sky attending full moon; and the gardener will do well to bear in mind the great likelihood of an appearance of frost at that change of the moon, about the time in spring he desires to transfer his plants to the open ground, and to delay the operation until it has passed.

After a warm rain, if the wind comes out strongly from the north-west, a reduction of temperature will follow and a frost during the night becomes probable, if the wind

*See Loudon's Encyclopædia, p. 445. Toaldo's 48 Years' Observations.

lulls before morning. No reliance can be placed upon warm weather at the time of rain; for the rapid fall of the thermometer under the above circumstances, is sometimes astonishing. Thus after a rain at one o'clock P. M. of April 3rd, 1879, the thermometer stood here (Wilmington Island) at 75° F., and under the prevalence of a north-west wind during the evening and early night, it fell 36°, giving us a killing frost on the morning of the 4th, at 39° at sunrise. Frost occurred also on the fifth and sixth, at 39°.

Among the many creatures that, like the swallow, have been thought to announce the advent of spring, I consider the appearance of the Tumble-bug (*Ateuchus pilularius*) and the Whip-poor-will, or Chuck-will's-widow, the most trustworthy. I have rarely known a frost to occur after hearing the voice of this bird in proclamation of the spring.

Below is a table of last frosts of the spring for a number of successive years on this and the adjacent Island of Whitemarsh, taken from the diary of the late R. T. Gibson, who kept a meteorological record for the Smithsonian Institute.

1835.—March 29th, cold wind from the N. W.; March 30th, frost; April 7th, said to have been frost, but saw none.

1836.—March 21st, rain; 22d, cold; 23d, frost.

1837.—March 4th, snow, five inches deep; April 7th, rain; 9th, wind N. W.; 10th, frost.

1838.—March 18th, cloudy; 19th, clear and cold.

1839.—March 5th, wind N.; 6th, sleet; 30th, rain, wind N.; March 31st, sleet and rain.

1840.—March 12th, rain; 13th, wind N. W., frost; March 25th, rain, wind W.; 26th and 27th, frost.

1841.—March 16th, rain and hail; 17th, wind N. W.; 18th, frost; 20th, frost; April 14th, light frost.

1842.—February 21st, cloudy; 22d, wind N. W.; 23d,

white frost; 24th, frost; March 23d, Melia Azedarach (Pride of India) in bloom; April 7th, Blackberries ripe; April 17th, hail the size of half-grown wild plums.

1843.—March 27th, rain; 28th, wind N. W; 29th, ice and frost.

1844.—March 7th, rain; 8th, wind N. W.; thermometer at sunrise 44°; 9th, 42°; March 20th, rain; 22d, wind W., frost.

1845.—March 24th, rain; 25th, therm. 42°; 26th, frost; April 10th, therm. at sunrise 43°, frost.

1846.—March 14th, rain, wind N. W. afterwards; 15th, 16th, and 17th, frost, therm. 38°.

1847.—March 26th, rain; 27th, wind N. W., therm. 35°; 28th, therm. 35°, frost.

1848.—March 13th, rain; 14th, therm. 37°, wind N. W.; 15th, wind N. W., therm. 32°; 16th, therm. 31°, ice; April 9th, rain; 10th, cold but no frost.

1849.—March 20th, rain; 21st, wind N. W., no frost.

1850.—March 23d, rain; 24th, wind N. W., therm. 39°, cold but no frost; 27th, rain; 28th, therm. 39°, wind N. W.; 28th, rain; 29th, frost.

1851.—March 16th, rain; 17th, therm. 46°, wind W.; 19th, therm. 44°, wind N. W.; 20th, therm. 34°, heavy frost; 28th, first Chuck-will's-widow.

1852.—March 17th, rain last night; 19th, rain at daylight; 20th, therm. 32°, wind N. W., heavy frost; 25th, first Chuck-will's-widow.

1853.—March 4th, rain at 7 A. M.; 5th, rain; 6th, therm. 35°, frost; 7th, therm. 34°; 21st, first Chuck-will's-widow.

1854.—March 23d, rain last night, wind N. W.; 24th, therm. 54°, wind N. W.; 25th, wind N. W; 26th, therm. 40°; 27th, frost; April 1st, rain; 2d, therm. 45°, wind N. W.; 3d, therm. 37°; 4th, frost, therm. 40°; 6th, first Chuck-will's-widow.

1855.—March 27th, rain; 28th, wind N. W., therm.

38°, too much wind for frost; 29th, therm. 30°, ice; April 14th, first Chuck-will's-widow.

1856.—March 26th, cloudy, wind W.; 27th, wind N. W.; 28th, ice; April 7th, first Chuck-will's-widow.

1857.—April 6th, rain, wind S. W.; 7th, wind N. W., therm. 40°, frost; March 29th, first Chuck-will's-widow.

1858.—March 5th, therm. 37°, frost; April 8th, first Chuck-will's-widow.

1859.—March 18th, rain; 19th, therm. 44°, wind N. W.; 20th, frost, but light—several times in April only prevented by wind; April 4th, first Chuck-will's-widow.

1860.—March 27th, cloudy; 28th, wind W.; 29th, heavy frost; April 5th, first Chuck-will's-widow.

1861.—March 18th, rain; 19th, wind N. W., snow; 20th, therm. 39°, frost; April 10th, first Chuck-will's-widow.

It will be seen from the above, that cold weather was invariably either preceded by rain, or cloudy weather, the probability being that there was rain somewhere in the district.

TO MAKE A HOT-BED.

The material most frequently used for the formation of hot-beds, when a considerable degree of heat is required, is stable manure, that of well-fed horses being the most effective. When a lower temperature suffices, a steady heat may be obtained by mixing vegetable matter, like leaves, spent tan bark, etc., with the stable manure. I have used with advantage a layer of our long moss (*Tillandsia usneoides*), about one foot thick, below one of stable manure, for forcing sweet potato draws, or sets. This moss, when taken up at the end of the season and cleaned, was in a merchantable condition as black moss. The manure, without too much litter, should be thrown from the stables into a conical heap, and kept moist for four or five days, when it should be turned

over. After the lapse of four or more days, according to the season, it will have acquired a steady heat, and be ready for use. The site for a hot-bed, or cold frame, should be on sandy, or gravelly, or well-drained soil, convenient to water, well protected from north and north-west winds; it must be free from overhanging trees and the shade of houses, but open to the sun from its rising to its setting. Unless the aspect of the bed be a point or two eastward of south, the plants growing at the eastern end will be dwindled by the shade of the frame.

The site having been chosen, the manure is placed either on the surface, or in an excavation, about six inches deep, in the shape of a solid parallelogram, extending in length and breadth, one foot beyond the dimensions of the frame to be placed upon it. Each layer of manure is evenly and moderately beaten down with the back of the fork, until about three feet thickness is attained, care being taken to have the pile uniformly moist throughout. The frame with glass is then put on, and air is given only during the day, unless the weather is warm, when it may be admitted during the night. After two or three days, fermentation will recommence, when the bed will be ready to receive its coating of six inches or more of garden soil for seed, for the forcing to maturity of cucumbers, etc. The frame should be as wide as the length of the sash, and its length will be determined by the number of sash. No bed should be constructed, if avoidable, for less than four "lights," and the longer it is, the more heat will be developed, and the more in amount will be retained.

In whatever manner the frame is made; whether the planks, which should be one and one-half inch thick, are nailed to corner posts, driven into the ground, or secured by battens, the chief outlook is, to have it fit closely in all its parts, and to have the sash adapted to it so snugly, that there will be no openings for the exit of warm, or the entrance of cold air.

A sufficient pitch will be secured to carry off the water, if the back is two feet, and the front one foot high. On each end of the frame a strip should be nailed to retain the two outside sashes in position. Each two sashes should be separated by a half-inch strip, nailed upon a three-inch-wide sliding piece, which latter is let flush into the edge of the back and front, and will leave one and one-fourth inch upon which the sashes are to rest and slide. If a small groove is made along each edge of the middle strip, the water will be carried off more effectually. The drip into the beds is sometimes damaging.

If the site is exposed to high winds, yellow pine is preferable to white pine for the sash, on account of its greater weight. The sash should be three by six feet, with glass not larger than eight by ten. The smaller the glass the less expensive the breaks. The panes are to be puttied to the sash, and to overlap each other like shingles. As dust collects between them and obstructs the light, the laps should not be more than one-fourth of an inch wide.

COLD FRAMES AND THEIR USES.

Such is a hot-bed. The site, the frame, and the sash for a cold frame are as above described. The difference between the two is solely, that the former is heated by fermenting material, which creates "bottom heat," while the latter is warmed by the confined heat of the sun alone. For a cold frame, the soil should be elevated six inches above the general level, and finely spaded up and raked.

Glass is the proper material for sash, and the cheapest in the end. Frames covered with cotton cloth may be used as a substitute, however. To render the cloth more translucent, the following ingredients may be used: one quart pale linseed oil, four ounces resin, and one ounce sugar of lead. The sugar of lead should be ground with a little of the oil, then the remainder of the oil and

resin, melted together, should be added, and the varnish applied with a wide brush while warm.

The following directions apply to the cold frame alone: According to the nature and size of the seed, and the character of the soil, the seeds are to be sown from one-fourth of an inch to an inch deep in drills, three or four inches apart across the bed, and more thinly at the back and front, than near the middle of the bed. Each variety should be sown in separate cold frames, or, when not practicable, only such should be sown together, as require about the same degree of heat to germinate, and particularly such as demand the same management and protection, until the plants are removed. Thus egg-plants should not be sown in the same frame with tomatoes, nor the latter with cabbages and cauliflowers, while the latter two may go together with lettuce in the same frame. If the weather is dry, and the soil sandy, a watering after sowing may be required to germinate the seed.

In the subsequent management, it must be borne in mind, that retardation for the production of stocky plants, rather than acceleration of growth, is an object, provided the seeds were sown sufficiently early. Dampness and heat produce an elongated rather than a healthy growth, and too much of either must be avoided. The glass is to be used only as a means of protection against the inclemency of the weather. In case of heavy rains, the sash should be pushed down sufficiently to carry off the water beyond the confines of the frame. During severe freezing weather, particularly in clear nights, when radiation is most active, the covering of glass alone will sometimes be inadequate to protect even as hardy a plant as cauliflower, and some opaque covering upon the glass becomes necessary. Mats, or light shutters of wood, are best. Old pieces of carpet will answer the purpose. For many years, I have used the leaves of our large palmetto

with satisfaction. One stirring of the soil between the rows, if attended with thorough weeding, will be cultivation enough for seedlings.

As soon as the plants are large enough to be safely handled, they should be thinned out to prevent crowding, and, as all kinds of vegetable plants raised in cold frames at the South are benefited by being transplanted, they should be pricked out into other frames, and set from three to four and one-half inches or more apart each way, according to variety and space at disposal. If no such extra cold frames are available, and the plants must remain in the seed-bed, until the final transplanting into the open field, then the thinning should be with the view to afford them space to grow strong and stocky, and the surplus plants may be thrown away. Before the final removal, the plants, whether pricked out or not, should be watered, in case the soil is dry, in order that earth may adhere to the fibrous roots, to keep them fresh, and facilitate transplanting. I have indicated how plants may be protected from the effects of frost, and may add that it will hardly ever pay the truck-farmer, planting on any but a very small scale, to resort to any means of protection. He should have a sufficiency of plants, however, to replace any killed by cold.

CHAPTER VIII.

TRANSPLANTING.

The following remarks are intended to apply to vegetable plants and to those of the strawberry only.

When a plant is removed from the soil in which the seed germinated, which provided it in its early growth with nourishment and moisture, the contact of the roots with

the particles of soil is not only interrupted, but some of the most important roots themselves are broken, and the plant is deprived of the absorbent points of the small rootlets. The evaporation from the leaves still continues, though moisture can no longer be absorbed by the roots. The important operation of transplanting is properly performed, when the equilibrium between these functions of the roots and the leaves is soonest reëstabtablished. If plants are transplanted to a wet, and particularly heavy soil, the part pressed to the roots will bake and contract, leaving cracks and open spaces near the roots. The earth, into which plants are to be shifted, should be freshly dug, as this seems to encourage an early emission of young rootlets; and it should be as fine as possible, so that every part of the roots may come in contact with soil and moisture.

By the removal of leaves, evaporation is not destroyed, but only diminished; for it also takes place through young bark. In our hot climates, a portion of the leaves of all vegetables, in proportion to the injury sustained by the roots, should be removed at the time of transplanting To what extent this must be done, will be given for each kind hereafter.

A moist state of the atmosphere prevents perspiration, or evaporation from the leaves, and such a condition is most favorable for transplanting. Still, with the exception of some very delicate plants not able to survive a dry atmosphere, such as cucumbers, etc., it is not necessary to await a rain before doing the work. If the earth has been freshly stirred, and is moist enough to allow planting holes to be made by the dibble, without caving in, and the soil is not very sandy, new roots will soon commence to grow, and the warm soil will push them rapidly forwards.

The truck-farmer, planting upon an extensive scale, has often to depend not only upon mere unskilled, but

upon stupid labor, and were it not for the seemingly imperishable character of some vegetables, the percentage of loss would be much greater. The planting is either too shallow or too deep, and the soil is not uniformly pressed to the roots, which are put into the ground improperly.

In transplanting such plants as the strawberry, the fibrous roots should be spread out as much as possible, while the root of a tap-rooted plant, as the cabbage, beet, etc., should be placed regularly up and down and not bent upon itself. If such a root is bent, the nutritive matter in descending from the leaves will be interrupted at the bend, and new rootlets will be slow to appear beyond it. In transplanting the soil should be uniformly, but not harshly, pressed to the roots their entire length, from the extreme lower point upwards.

With the exception of asparagus, horseradish, onions, and such plants as emit new roots along the lower portion of the stem, as tomatoes, cabbage, etc., it is a safe rule to put down the plant to the depth at which it originally grew.

In sandy soil it occasionally becomes necessary, in a drouth, during an entire transplanting season, to water the plants after they are set out. In this case the watered surface should be covered with dry soil to prevent baking.

In a loose, fine, light soil, free from sticks, shells, pebbles, etc., the hand alone may be used in transplanting on a small scale; but either the planting stick or dibble, or the trowel is preferable. The trowel is the safer implement in the hand of an unskilled workman. In using the dibble, it is thrust into the soil to make a hole to at least the full depth at which the plant is to be inserted, the hole is then widened by a rotary motion of the implement. To insert the plant properly, it is held between the thumb and index finger of the left hand, and thus placed in the hole; the dibble is then plunged

into the ground two or three inches from the plant in a direction with its point toward and a little below the end of the root. The engraving, figure 3, shows the hole made by the dibble with the root of the plant within it. The dibble is thrust into the ground, ready to fix the root in place; by using the point, *a*, as a fulcrum, and moving the handle of the dibble from *b* to *c*, the soil

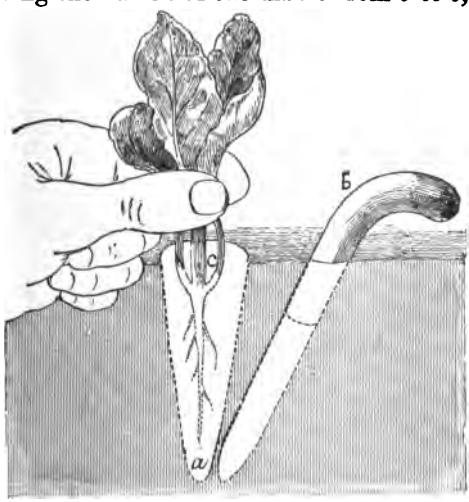


Fig. 3.—PROPER USE OF THE DIBBLE.

will be pressed to the root for its entire length, from *a* to *c*. If this is done with sufficient force, it will fix a delicate plant so firmly in the soil, that if it be pulled by the top of a leaf, that will give way before the plant can be pulled up. If the dibble is inserted perpendicularly or parallel to the plant, instead of at an angle, or if it be partly withdrawn, before the movement from *b* to *c* is completed, the soil will only be pressed to the root at the top, leaving its more important part loosely suspended in an open excavation in the soil, as seen in fig. 4. Planting proceeds most conveniently from left to right. When

the trowel is used, the operation is the same, except that the implement is inserted in front of the plant, instead of at the side.

When plants are taken up so carefully that few of the small roots are ruptured and with the soil adhering, or when they are turned out of flower-pots, they will start

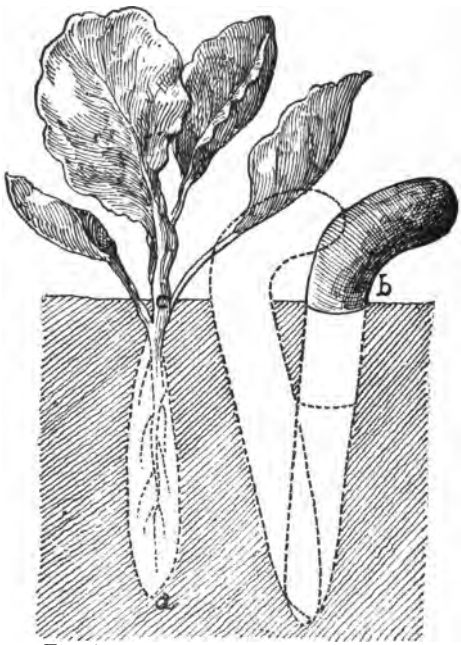


Fig. 4.—IMPROPER USE OF THE DIBBLE.

more readily; but they will not make so luxuriant a growth of leaves, nor will they develope as much fruit, as when a part of the roots has been broken. This is not in consequence of the rupture in itself, but because at and above the points of injury, numerous small fibrous roots are emitted, which are capable of providing the plant with an increased amount of nourishment.

The following table by Werner shows the leaf surface of ruta-baga turnips both of plants grown directly from the seed, and of those subsequently transplanted.

	Average Number of Leaves.	*Average Surface of each Leaf.*	*Average Surface of all the Leaves.*
Ruta-baga Turnips directly from seed.....	18	150 sq. centimet's.	2,700 sq. centimet's
" transplanted....	18	190 " "	3,420 " "

CHAPTER IX.

WATER AND WATERING.

Water is the medium by which the soluble matters of the soil are conveyed, through the roots, into the interior organism of plants. We know that the earth, only apparently dry, cannot support vegetation. The more advanced the state of growth, so long as the foliage remains young and succulent, the more moisture does a plant need. An important fact in the relation of vegetation to moisture is seen in the effect the humidity of the atmosphere has upon its temperature. Without more or less vapor in the atmosphere, radiation would cool the surface of the earth so rapidly as to destroy the life of all tender plants. The hottest rays of the sun pass through the air, even when that is saturated with moisture, without heating it; but the heat radiated from the earth, and every object upon it, is intercepted and absorbed by the humidity in the air; and the atmospheric warmth is therefore in proportion to the heat of the sun's rays and the moisture of the air. Like the covering of a cold frame, the moist air admits the heat by day and

prevents its departure at night. Hence the clearest, driest nights are the coldest. Hence the driest regions, like the desert of Sahara, have the coldest nights, and the cold of high elevations is due to the same cause.

Prof. Tyndall says: "The removal, for a single summer night, of the aqueous vapor from the atmosphere that covers England, would be attended by the destruction of every plant which a freezing temperature would kill." Humidity and temperature are therefore intimately connected.

Although the heat of the sun causes evaporation from plants, its amount is governed by the humidity of the air and the velocity of the wind. If the gardener could regulate the moisture of the atmosphere surrounding his crops, and make it most favorable for keeping up the proper evaporation, by applying water artificially and only in circumscribed limits, to their roots, he could be assured of success. While he may do so in his greenhouse, there are no means of regulating the heat and moisture of the open air. It is therefore that watering out-door crops, in our hot climate, is more often productive of harm than of benefit.

When the earth is naturally moistened by rain, the whole air is saturated with moisture, preventing a too rapid perspiration from the leaves and the evaporation from the soil. If watering is done at all, it should be in cloudy weather; but it is most frequently injudiciously practised in dry, hot weather, and so circumscribed in extent, that it can have little or no effect upon the atmosphere. The roots are temporarily excited, and the dry, hot air robs the plant of the moisture through the leaves as rapidly as it can be pumped up by the roots. As soon as the temporary supply is exhausted, the plant not only returns to its former state of suffering, but is left more susceptible to injury than before. If the watering is repeated, the emission of rootlets near the surface is en-

couraged, and these grow, merely to perish again unless the water is continued. Another injury may occur through the decrease of temperature caused by rapid evaporation and perspiration.

In our hot climate, during drouths, vegetation is greatly sustained by the moisture which is returned to the earth in the form of dews; and in order that these may be most beneficial, the soil should be deeply stirred and continue in a mellow condition upon the surface. When the soil is puddled and compacted around a plant by local watering, the amount of dew will be less from the decrease in the number of points of radiation presented by the compact ball; besides the diminished quantity is evaporated from the impenetrable crust without being able to reach the roots. If watered, the earth should therefore be stirred subsequently, or the watered surface be covered with fresh, loose soil.

If practised at all, the watering should, in hot weather, be applied to the roots and not to the foliage. Evening is the proper time of day, unless in the exceptional case of watering cold frames, when frost is apprehended. It is then advisable to water in the morning. The water should not be much colder than the surrounding atmosphere. Where there are facilities for moistening the whole mass of soil by irrigation, that should not be neglected; for its great benefits are undoubted. But even then, unless the surface is so densely covered with the growing crop, as to protect it from being baked by the sun, it would be best to allow the moisture to reach the roots through percolation from ditches or drain pipes near enough to each other and kept full, than to cover the soil with water. A crop supplied with a sufficiency of soluble manure will suffer less during drouth than one inadequately fertilized, and the latter will require an abundance of water.

The fertilizing effects of mulching the soil are men-

tioned elsewhere. It remains here to be remarked that a mulch or covering to the soil will shade the ground from the hot sun and maintain an equal temperature. It prevents the too rapid evaporation and drying of the soil, and is therefore to be recommended with or without watering.

CHAPTER X.

PACKING AND MARKETS.

It should be remembered by the grower and shipper of fruit and vegetables to Northern markets that, while his produce may be of the best quality, it will return him unsatisfactory prices, if put up in packages which present to the buyer an unattractive or unclean appearance. His first consideration, then, after securing a good crop, is to have his barrels, crates, etc., clean and bright, and well and symmetrically made, neatness being very important. The matter next in importance is, that the packages be not only full at departure, but that they be also full on their arrival at their destination. They should not, therefore, be filled in a careless, haphazard manner, hastily headed up, and hurriedly dispatched. The contents should be so placed, or thoroughly shaken down, whenever the character of the article will permit, as to leave no vacant spaces to be filled out by the jarring received in transit, thus causing an empty space at the top, and permitting the stuff to be bruised by being shaken or rolled about within the package. The contents of the barrel or crate should bulge up beyond the level, so that force will be required to press on the head or cover. A slight bruising of the upper layer is of but

little consequence. Special directions will be given for packing each variety of vegetable. No vegetable or fruit of inferior value (I am not alluding to size), with the slightest indication of decay or of over-ripeness, should be put up; for the packer should bear in mind that a speck, now only faintly perceptible to him, will some days later appear as an odious blemish in the eyes of the purchaser. The decay of a single individual may be communicated to and injure the rest.

If vegetables or fruit of a second quality are worth less at home than if forwarded, let them be put up in separate packages, and not allowed to detract from the quality and market value of the first grade by mixing the two together. If articles of the first quality and the "culls" are shipped in separate packages, they bring better prices than when they are put up together. The decrease in value is out of all proportion to the slight increase in bulk.

The pernicious habit of packing articles of a better quality at the top of a barrel or other package, and those of an inferior below ("deaconing" or "topping"), is neither more nor less than an attempt at fraud, to be shunned by every honest grower, while it is a reflection on the discernment or acuteness of the buyer. To the gardener who expects to continue shipping vegetables, who hopes for satisfactory returns, and wishes his brand or mark favorably known in the markets to which he sends his crops, I should recommend the other extreme.

The laths of a crate should not be far enough apart to allow their edges to indent or cut such vegetables as tomatoes, cucumbers, etc., and yet be sufficiently distant to ventilate the package as much as possible. The heads and sides of barrels should be cut to admit air freely. None but good, strong, clean, round-hooped potato or flour barrels should be used for shipping purposes.

BUSHEL AND BARREL CRATES.

A bushel crate requires a centre-piece and two end-pieces; these are eight by fourteen inches. The laths two feet in length, and of a width suited to the kind of vegetable to be packed. For tomatoes, the laths should be fully two inches wide. For purposes of ventilation and convenient handling of the crate, the middle and

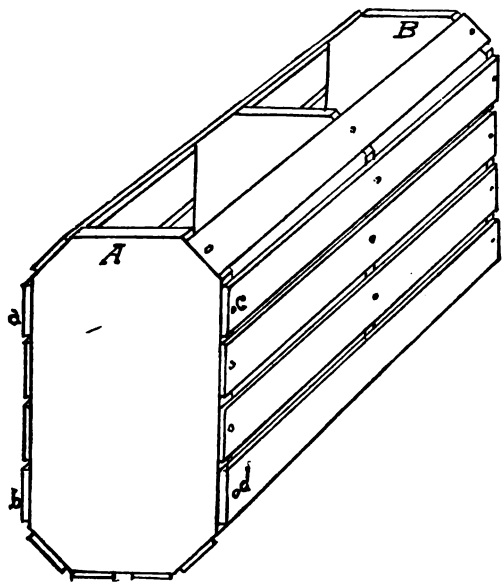


Fig 5.—A BUSHEL CRATE.

end-pieces are made octagonal by having the corners sawed off. The capacity of such a crate is two thousand two hundred and twenty-one cubic inches, while a legal bushel contains two thousand one hundred and fifty cubic inches. The width of the lath should be about one-half inch less than the dimension at the corner, in order to permit access of air when the crates are closely stowed on shipboard. The figure represents a bushel crate ready

for packing. If the first four laths with which the construction of a crate usually commences, *a*, *b*, *c*, and *d*, in figure 5, are a trifle thicker than the others, ventilation will be more effectively secured in a pile of crates.

If the contents are to be shaken down, two laths are placed loosely over the bulging vegetables, to prevent their jarring out; and grasping the ends of the crate at *A* and *B*, each end is lifted by the packer, and allowed to come down alternately with a sudden thump, and this

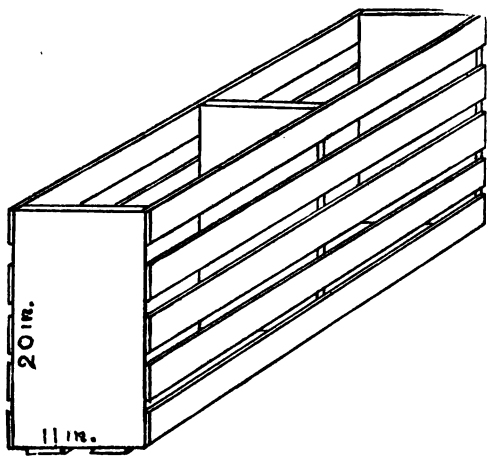


Fig. 6.—A BARREL CRATE.

process is continued until the contents have thoroughly settled.

Each crate should be plainly and neatly marked by a stencil plate on both ends, with the name or initials both of the shipper and the consignee. When a mark has been adopted, it should be retained, so that it may be known by the buyers. Old brands on second-hand barrels should be thoroughly removed by the scraper, before they are marked.

The wood from which the crates are made should be

inodorous. On account of its odor, cypress is objectionable. Sappy yellow pine makes the brightest, lightest laths, and splits less readily than heart-wood.

The dimensions of the barrel crate (fig. 6) are eleven inches wide, twenty inches deep, and thirty-nine inches long. These crates are best made of slats, $^3/_8 \times 2^1/_2 \times 39$ inches, and $^3/_4 \times 2^1/_2 \times 39$ inches. A thicker slat is nailed on the edges of the end pieces, to afford ventilation, and the crates are headed up with pieces $^3/_4 \times 6 \times 39$ inches.

Figure 7 shows six strips, nailed upon thick plank, in order to hold the head and centre-pieces upright, and at the proper distance apart, facilitating the making of

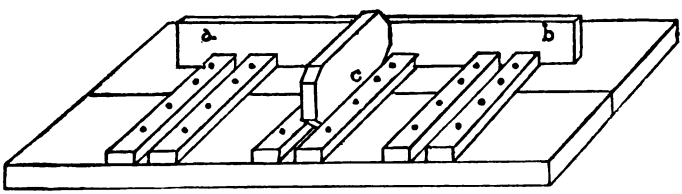


Fig. 7.—BLOCK FOR NAILING CRATES.

crates. At *c* is a centre-piece in position. These are aligned by having all touch the board, *a*, *b*. The most convenient position for nailing crates is a seat on a low stool, in front of the above platform on the floor, though a standing position might suit a young person better. Of course the material, including nails, should be within easy reach.

THE MARKETS.

To market a crop profitably, or to know where and to whom to consign it, is as indispensable to the farmer, as to be able to produce it successfully. While an article may command a good price in one market, it, at the same time, may hardly pay the freight charges in another. Even distinct varieties of the same vegetable may suit one market better than another, and it is necessary

to learn the peculiarities of each. Tomatoes are sold to better advantage in Baltimore and Boston than in any other Northern market. Cauliflowers and melons will not pay in Baltimore, while both sell well in Boston and New York, the former being a better market than New York for melons. The red sweet potato, although not the popular variety, is more salable in Boston than in New York. White onions will sell higher than red ones in New York, while there is but slight difference between the two in Boston. I have rarely had reason to be pleased with sales in Philadelphia, and of late years have shipped very little to that market; nevertheless I am constrained to add that I have been told of several satisfactory sales there during the past season. My experience has taught me that New York is, on the whole, the best market for the bulk of the crops.

I have no personal knowledge of the Western markets and commission merchants; but I learn that the shipments have given satisfactory returns. It is probable that, with improved transportation facilities, considerable shipments will be made to the Western cities hereafter. In every market there are doubtless many excellent, honest, and trustworthy firms, the standing of which, as that of all others, is ascertainable at mercantile agencies. Old and experienced truck-farmers have their tried and approved consignees, and it is important for the beginner to exercise great care in the selection of his commission house, and, when one has been fixed upon, it is not well to make a change for a trivial reason.

CHAPTER XI.

INSECTS AND THEIR REMEDIES.

The working farmer is so occupied in the pursuit of his profession, and by the study of the phenomena by which he is surrounded, upon a correct appreciation of which his success will largely depend, that he rarely has sufficient time to devote to botany or entomology as a science. The laws of vegetable growth, an intimate knowledge of useful and noxious plants, and, above all, a clear perception of, and discrimination between his friends and foes in the insect world, are among his urgent needs. Next to the contingencies of season, his prosperity will depend upon the extent of insect depredations. Millions of dollars' worth of property are annually destroyed by insects, and a knowledge of their habits is required, that we may learn how to deal with them, in order to stay their ravages. If farmers more correctly appreciated the aggregate losses by insects, they would probably take a deeper interest in studying them.—(See Exodus x: 5, 14–15.)

In A. D. 591, a vast horde of locusts ravaged Italy. From the stench of their decaying carcasses arose a pestilence which carried off nearly a million men and beasts. In the Venetian Territory, in 1478, the same insect created a famine, during which thirty thousand persons died of starvation. So well did the Arabians know their power, that they make a locust say to Mahomet: "We are the army of the great God; we produce ninety-nine eggs; if the hundred were completed, we should consume the whole earth and all that is in it." Professor Riley estimated the annual loss from insect depredations in Missouri at fifteen to twenty millions of dollars, and the

losses in the United States probably amount to such an enormous sum, that nearly fifty million dollars might be saved through a more generally extended knowledge of the habits of insects. If insects play such a part in our economy, and, if the farmer's property is more liable to injury than that of any other class, who more than himself should be interested in them, and the remedies to abate the evil? There is no part of animated nature more vital to our welfare than insects, of which there are about fifty thousand species inhabiting the United States.

The study of entomology has been frequently looked down upon by the ignorant with ridicule, in consequence of the minuteness of many of its objects; yet it is exactly in these small members of creation that are exhibited the most wonderful adaptations of means to purposes, and the most amazing wisdom of the Creator!

Can the tiger, with its fierce leap, by which he catches his prey, and the retractile claw, by which he secures it, or the giraffe, with his long neck and tongue, by which he reaches the leaves, many feet from the ground, be compared with the spider? This insect lurks behind a screen of its own manufacture, ready to pounce upon and tie up any helpless insect, which conveys to it by the vibration of the web, the intelligence of its entanglement. In this web each single thread consists of many thousands of finer strands, a part only of which in the net of geometric spiders, the circles, is provided with a viscid covering to hold the captive. Which seems the greater manifestation of divine wisdom: the clumsy she bear that brings food to her hungry cubs, directly appealing to her maternal care, or the sand-wasp, which, after depositing an egg in a cell at the bottom of a cylindrical cavity in the sand, supplies the future larva with food in the form of insects? She so regulates the number of these, that the larva may have sufficient food; she stings the insects,

without killing them, as they would then putrefy, but just enough to keep them in a dormant state until wanted. How wonderful the instinct of a mother to provide food for offspring she will never behold! Every individual of the species, the descendant of countless ancestors, has thus fulfilled this maternal duty for ages past. Had the sand-wasp, for a single season, neglected its instinctive work, there would be no "horse-guards" to keep the cow-fly under control, and in a measure to protect our cattle on the sea coast from their annoyance. The most efficient aids to man in keeping the increase of injurious insects within due limits, are their natural enemies of the insect world, and some of the insectivorous birds; for other birds devour indiscriminately, both the useful and injurious insects. There are also certain families of insects, which depredate upon the farmer's crops, and diminish his income, and certain other kinds, which prey upon these, and are therefore our friends and auxiliaries. Horticulture, it has been truly said, is a war with insects, and we must antagonize the former, and wage a relentless war against them, while we patronize, protect, and foster the useful insects to the best of our abillty.

If the farmer remains ignorant of these mutual relations between insects, a knowledge of the more common instances being readily acquired, how is he to discriminate between friend and foe, so that he may not be guilty of the evident impropriety of destroying both? How often has the useful little friendly lady-bug been mistaken for the parent of the plant-lice, and been pitilessly destroyed?

If he that makes two blades of grass to grow, where only one grew before, is a benefactor to mankind, he that protects both from needless destruction, is not less a benefactor! Therefore, while it is not within the power of man to wipe injurious insects from the face of

the earth, he may limit the destruction of property they cause, and it is to the farmer's interest, and is his duty, to wage a united war against them, knowing no to-morrow in its prosecution, but killing and destroying wherever and whenever possible, and employing every means in his power. Individual effort can avail little, and concerted action is necessary.

In our climate, insects generally have two broods in a season. Most of those which survive the winter in their perfect state are fertilized females, and all insects, if left unmolested early in the season, will propagate their species, and the second brood will outnumber the first a hundred or a thousand-fold.

While recommending a determined crusade against all insect pests, I would, from the same motive, protest against the pernicious habit, so common all over the country, of indiscriminately taking the life of the lower animals inhabiting the fields and woods; for the reason, that many reptiles, the toads and moles, are our innocent friends and aids. There are but very few venomous snakes, and the larger kinds, which are not insectivorous, destroy numbers of field rats and mice.

PARASITIC INSECTS.

We are occasionally subject to the visitation of an insect in vast numbers; but these generally bring with them the cause of their own limitation, or there would be no equilibrium in nature. Swarms of parasitic insects, finding an increased food supply, follow in their wake, and the farmer, aroused from his apathy, by finding his entire crops, and not merely a portion thereof, endangered, resorts to all sorts of devices to save them. He dusts and sprinkles poisons, he digs circumscribing ditches with upright sides and pitfalls, and applies the torch and burning petroleum.

Previous to 1862, the European cabbage butterfly

(*Pieris rapæ*), the parent of the cabbage-worm, was unknown in this country. It was at that time introduced into Canada. Finding in the cabbage fields near Quebec an abundance of food, and meeting no checks, it improved its opportunities and propagated its species to such an extent, as to cut short the cabbage crop of the vicinity in one season to the extent of forty thousand dollars.

Suddenly its own especial enemy, the little Chalcid fly (*Pteromalus puparum*) made its appearance, presumably direct from Europe; and in turn, finding its appropriate food in abundance, propagated its species so rapidly, that, now in sections where the cabbage-worm was most plentiful, neither the one nor the other is often seen; thus showing the beautiful working of checks and counter-checks in the general plan of nature.

THE MIGRATION OF INSECTS.

The number of injurious insects is on the increase all over the world. The interchange between different sections, different countries, and even different hemispheres, of noxious insects, indigenous to each, is constantly occurring, as shown by the case of the just-named *Pieris rapæ*. The Colorado potato-beetle once gained a foothold in Germany; but through the paternal care of the government, the large potato field, where he was observed, was covered with inflammable material, and that country was promptly made too hot for him.

The Colorado potato-beetle has marched eastward to the coast, a curse and ravager of every farmer on its route, while the harlequin-bug (*Strachia histrionica*), coming north from its home in Mexico, will cross the line of the other, unless it reaches a climatic limit to its onward progress. An abundance of food has recruited the ranks of noxious insects, and is still exerting the same influence. Before the introduction of the cab-

bage into Mexico, the insect just named was probably much more restricted in numbers, and changed its habit from some plant of the mustard family or other, to the more acceptable and delicate food of the cultivated cabbage. This insect was found a few years ago feeding on Ossabaw beach on a plant, I think, of the family Salsoleæ.

In the fall of 1880, I found the larvæ of the little *Botys repetitalis* on cauliflower, and a few days afterwards my daughter found it, probably on its native food plant very abundantly, — the common rag-weed (*Ambrosia artemesiæfolia.*) Of this and other instances of change of habit coming under my own observation, Prof. Riley says in one of his reports:

"Under the head of new cabbage insects should be included this insect, which was first described as *Botys repetitalis* by Mr. Grote, on page 270 of the last Annual Report of the Department of Agriculture. Larvæ of this insect were originally received from Dr. A. Oemler, of Wilmington Island, at the mouth of the Savannah River, etc."

In a contribution to the "American Naturalist," under the title of "Change of Habit; Two New Enemies of the Egg Plant," Prof. Riley says: "In our writings on the Colorado potato-beetle, we have repeatedly drawn attention to the fact that *Doryphora juncta*, although a native of the Atlantic States, and living in the midst of our cultivated species of *Solanum*, has yet never shown any indication to leave its natural food plant, the wild horse-nettle (*Solanum Carolinense*) for the cultivated species of the genus. We have now for the first time to record its appearance as an enemy to horticulture, Dr. Oemler having found it—larvæ as well as beetles—feeding on his egg-plants in the earlier part of June. There can be no doubt about the correctness of Dr. Oemler's observations, as the specimens were sent to us for determination. This is another

of those instances of remarkable and sudden change in the food-habit of a tolerably common and otherwise well-known species, which led us to the remarks on p. 152 of this volume anent 'New Insects Injurious to Agriculture.' As in other cases of this sort, the causes of such changes are not readily ascertained. In this particular case, the new habit may be only temporarily developed in a restricted region, either by the disappearance or the poor condition of *Solanum Carolinense;* or it may become permanent, and cause *D. juncta,* hitherto looked upon as harmless or even beneficial, to vie with its ten-lined relative in destructiveness. Time alone will indicate, as we have no grounds upon which to base any confident prediction." I may mention that the horse-nettle was neither absent, nor in poor condition, and, that after writing to Prof. Riley, I found the perfect insect on both egg-plant and the former.

The same author writes: "Another case very similar to that just mentioned, may here be recorded. There is a small tortoise-beetle (*Cassida Texana*) easily distinguished from its congeners by the uniformly pale-green color of its upper surface, and the coarse striæ of punctations on the elytra. In 1879, we found it in all stages abundantly in Southern Texas, feeding on the leaves of *Solanum elæagnifolium.* Dr. Oemler now writes (June 13th) that he finds eggs, larvæ and imagos of this beetle quite commonly depredating on his egg-plants, though there is no previous record of any such habit, and, indeed, the species is not recorded from the Atlantic States, albeit we have found it this very season at Washington on *Solanum Carolinense.*" Probably neither of these insects may ever become very destructive pests; but finding in our cultivated crops more abundant and succulent food than its former, wild-growing and tougher food plant afforded, the probabilities are that both will increase, and the present is the proper time for their destruction.

In whatever state an insect species is accustomed to exist through the winter, or to hibernate (and it is done in the case of a few in more than one condition), no degree of cold likely to occur will affect them; therefore the popular idea that a hard winter is destructive to insects is a fallacy; except that such as are turned up by the plow in very cold sunless weather may, in their benumbed state, become an easier prey to insectivorous birds. There is more truth in the reverse statement, that a mild winter is destructive to insects.

The influence of a certain degree of heat for a sufficient time will hatch the worm as well as the chick, or bring forth the butterfly from its chrysalis. If a worm is born after a mild spell in winter, and finds no food in readiness, it naturally must perish from starvation, and if a butterfly appears, it must suffer from the same cause. Either may perish from cold it was not expected to encounter. Even in case of survival, there would be no breeding during the uncongenial weather.

THE RAPID REPRODUCTION OF INSECTS.

The Creator in his wisdom has ordained that the smaller animals and insects, which are most subject to predatory enemies, shall be endowed with the greater fecundity. The queen of the white-ant lays sixty eggs in a minute, eighty thousand in twenty-four hours, and forty million during its existence of two years in the perfect state. Ants, birds, reptiles, beasts, ever near, make food of them, when they come forth in countless numbers at the commencement of the tropical rainy season; so that of many millions scarcely a single pair escapes to lay the foundation of a new colony. A single plant-louse may, in five generations, become the ancestor of seven hundred and twenty-nine million individuals; and there may be twenty generations in a season. Dr. Fitch ascertained, by actual experiment, that the fecun-

dity of the grain-aphis was still greater. The wingless females become mothers at three days old, and bear four little ones every day, every one of which is a fertile female from birth; so that in twenty days the descendants would exceed two millions. Only the next to the last brood of the season consists of both male and female, when the eggs are fertilized for every generation of the ensuing season but the last, all the other broods being born alive. No insect is more subject to being preyed upon. In all nature a contest is going on for existence, the weaker always succumbing. This is the struggle for the "survival of the fittest," as Darwin terms it.

If we sow our seeds too thick, we see some of the plants overtopping and smothering the rest; we see in a growth of young pine saplings that some of the trees are dying out, in order that the more vigorous may have more room. In this wise ordinance of the Creator, that only the stronger individuals shall propagate their own species, He has established a safeguard against deterioration; and it seems that He has not only endowed the stronger with greater powers to resist deleterious influences, but has implanted in such lower orders of beings, which are frequently the cause of disease and death, an inclination, a selection, to infest victims least able to resist their inroads. The sleek, well-fed horse will not be subject to itch; the well cultivated and vigorously growing orchard is not apt to be attacked by bark-lice.

The above is, at least, the only reasonable explanation I am able to offer of the fact, often observed by cabbage growers, that plants in luxuriant growth are rarely attacked by leaf-lice, whereas a field that is backward in growth, and feeble in health, will be overrun by them. This is such a general observation, that Gregory says: "Considering the circumstances under which the insect appears, I hold that it is rather the product than the cause of disease."

THE CLASSIFICATION OF INSECTS.

This is not a book on entomology, and I shall avoid, as much as possible, the description of insects and the use of technical terms, preferring to present the most important species to the eye in the form of an illustration.

For the better understanding of future references, I must, however, enumerate the orders into which insects are divided, and the transformations they undergo.

ORDERS.

I.—*Hymenoptera.*—Example, bees, ants, wasps, ichneumons.

II.—*Coleoptera.*—Shield-winged insects. The beetles. Example, the fig-eater; Colorado potato-beetle.

III.—*Lepidoptera.*—Butterflies and moths. Example, the cotton-worm and tomato-worm moths.

IV.—*Hemiptera.*—The bugs. Example, the plant-louse.

V.—*Diptera.*—Two-winged insects. Example, common house fly.

VI.—*Orthoptera.*—Straight-winged insects. Example, the grass-hopper.

VII.—*Neuroptera.*—Nerve-winged insects. Example, the dragon-fly, or mosquito hawk.

There are also minor divisions, but the orders will answer our purpose.

The four stages of insect life are:

First.—The egg, which hatches and produces:

Second.—The larva (worm, grub, maggot, caterpillar), which goes into the state of the:

Third.—Pupa or chrysalis, often enclosed in a silken cocoon. Out of the pupa appears the:

Fourth.—Imago, or perfect insect.

These changes of form are truly wonderful.

The cabbage insect, for instance, from being a worm, crawling slowly about upon sixteen short feet, and greedily devouring, with two strong jaws, about twice its own weight of cabbage leaf daily, and seeing out of twelve minute, nearly invisible eyes, transforms itself, first into a motionless, sightless chrysalis, and then into a flitting butterfly, with six long, wholly dissimilar legs, ten having completely disappeared. Instead of the twelve invisible eyes, it is now provided with two prominent ones, each composed of about seventeen thousand convex lenses, every one supposed to be a separate eye. Instead of the two strong jaws, we see a long, flexible proboscis for the extraction of the nectar of flowers, now its only food. The shape of its head is completely changed, and from it project two horns, which are the organs of touch.

The insects that infest particular vegetables will be mentioned further on, in treating of their special food plants.

Of omnivorous insects, or general feeders, those which first claim our attention, on account of their general destructiveness, are:

THE CUT-WORMS.

These are the larvæ of several genera of night-flying owlet or rustic moths (*Noctuidæ*), the genus *Agrotis* furnishing the most numerous species, while those of *Mamestra, Hadena,* and *Celæna* are more rare.

Prof. C. V. Riley has made a special study of cut-worms, and has described, in his First Missouri Report, the habits of twelve distinct species, and subsequently of several others.

Ordinarily, the moth attaches her eggs in early spring and late summer to vegetation near the ground; but sometimes the eggs are laid on the leaves of trees, upon which the worms do not feed, but from which they descend as soon as born. Soon after it is hatched, the young

worm descends below the surface of the soil, but comes up nightly for food, cutting tender plants. Retiring about sunrise, it sometimes draws a part of a leaf into its burrow. Some distinct species ascend trees to cut the buds, and are the climbing cut-worms. They are all mostly dark-colored, greasy, smooth-looking worms, mottled with white, bearing a general resemblance to one another, and when full grown are about an inch and a half in length. They curl up, when disturbed, and are torpid in the cold of winter; but in our climate, with every warm spell, they become lively, and hungry enough to continue their depredations periodically throughout the

Fig. 8.—GREASY CUT-WORM (*Agrotis telifera*, Harr.). Fig. 9.—LARVA.

winter. They hibernate at the South in both the larva and the pupa state. When full grown, the worm goes deeper into the ground, and forms an oval chamber in the soil, in which it goes into the pupa state. In the warm weather of spring, the moth comes forth in from two to three weeks afterwards. It is generally of a gray or brown color, with slight differences of darker markings and colorings, on the front wings, and has a spread of wings of about an inch and a half. When at rest, it sits with the wings folded against the body, the lower being covered and out of sight.

In order to familiarize the eye with the appearance of the parent moths, as well as that of the worms, engravings of several of the species are given.

The Greasy cut-worm (fig. 8; larva, fig. 9), is very

widely distributed, it being found in nearly all parts of the United States, and attacks many very different plants, sometimes destroying whole fields of corn and of tobacco. The parent moth (fig. 8), is known as the Lance Rustic (*Agrotis telifera*, Harr.), which often enters

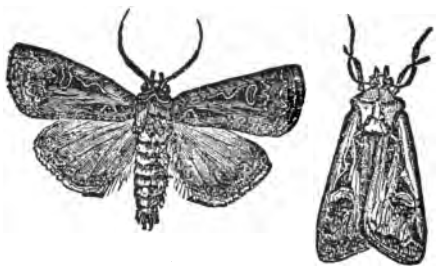


Fig. 10.—MOTH OF WESTERN STRIPED CUT-WORM (*Agrotis subgothica*).

the house at night. The general color of the fore-wings is dark-brown, and the hind-wings are pearly-white.

The most common species in Georgia is called the Western Striped cut-worm in the books, though it is quite as common at the East and South as elsewhere. It is dirty-white or ash-gray in color, sometimes yellowish, and has dark stripes on the sides. The moth, known as the Gothic Dart (*Agrotis subgothica*, Harr.), is given in fig. 10, with the wings both open and closed. The darker

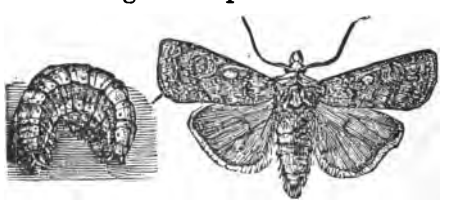


Fig. 11.—DARK-SIDED CUT-WORM (*Agrotis Cochranii*).

parts of the wings are deep-brown, and the lighter portions are of grayish flesh-color.

The Dark-sided cut-worm, of which larva and moth are given in fig. 11, is *Agrotis Cochranii*, Riley. It is

one of the climbing species, and very destructive to the buds of fruit trees.

The W-marked cut-worm (fig. 12), is the larva of the Clandestine owlet-moth (*Noctua clandestina*, Harr.). It attacks various vegetables, and also climbs.

The Glassy cut-worm, the larva of *Agrotis* (or *Ha-*

Fig. 12.—W-MARKED CUT-WORM (*Noctua clandestina*, Harr.).

Fig. 13.—GLASSY CUT-WORM (*Agrotis devastata*).

dena) *devastata* (fig. 13), is glassy-green, with a bright red head, with a hard, dark-brown shield just back of it.

The small White, Bristly cut-worm (fig. 14), *Celæna*

Fig. 14.—SMALL WHITE BRISTLY CUT-WORM (*Celæna renigera*).

(or *Hadena*) *renigera*, is very small, and a general feeder, often destructive in the flower garden.

Entomologists, in their revision of these insects, have made some changes in the scientific names. Those here given will direct the reader to the detailed descriptions in the entomological reports and other works.

As the moths of the various cut-worms fly at night, and are attracted by light, it has been recommended to make open fires in the fields; and even several fire-traps have been invented, into which night-flying moths have been enticed and killed. These fires are of very questionable utility, since it may happen that more beneficial than noxious insects may be destroyed.

REMEDIES FOR CUT-WORMS.

Many remedies have been recommended to kill or drive away cut-worms, such as ashes, salt, lime, gas-lime, copperas, sulphur, etc.; but I know of none, harmless to plants, worth the trouble of application. Some have been deceived by the disappearance of the worm at the time it is about to undergo its changes, ascribing it to the effect of a remedy. Dilute washes of soap, tobacco, etc., do not seem to be repulsive to cut-worms. Pyrethrum, the mere touch of which is so deadly to some insects, seems in the open air perfectly innocuous to these, and they soon recover, even after being covered with it for half an hour or more in close confinement.

Covering the stems of plants above and below the surface of the ground by a funnel-shaped fold of paper or tin, or surrounding a cucumber or melon hill similarly with a hoop of wood or iron, may be a protection, but is a process too troublesome and expensive for the truck-farmer.

Round holes made in loamy or heavy soil by the insertion of a stick are said to entrap these worms, which may be killed the next morning by re-inserting the stick. This is one of the few remedies, the utility of which I cannot deny from actual experience, never having cultivated land heavy enough to prevent the worm from promptly burrowing himself out of the trap. On a large field the small holes, to entrap them, would necessarily be very numerous, and the labor of re-inserting the stick into each, whether empty or full, would condemn the remedy.

The instinct of the parent moth will lead it to place its eggs only where the future worm will find its proper food; and if a field upon which the gardener expects to put out valuable plants in the spring is kept bare of vegetation during the months in which the eggs are laid, it will be free from cut-worms. If plowed up later, and then kept bare during the winter, the worms will migrate

to better pastures, which may even be provided for them with advantage. But a bare fallow is destructive to fertility in our climate, and a thick mulch should be provided, which when burnt off will destroy crickets, etc., harboring under it. I can vouch both for this plan as a measure against cut-worms, as well as a means of fertility; but it is rarely practicable. If in the rotation a clean fall crop, not subject to cut-worms, can precede the one to be put out, the latter will not be apt to suffer from them. A cut-worm generally indicates its presence, by a destroyed or injured plant, a cut leaf, or freshly stirred soil, and, on a small scale at early morn, it may be hunted at the root of the plant and killed; but never until some damage has already been done. When the soil is damp, the worm is generally to be found at early morning near the surface. In dry sandy soil, and as the day advances, it burrows deeper.

My method of dealing with cut-worms, of late years, has been to remove them from the field, before the crop to be jeopardized is up, or the plants are put out.

By placing cabbage leaves and bunches of grass along the rows of watermelon hills four years ago, I caught, by hunting them daily, fifteen hundred and thirty-eight worms on about one-fourth of an acre, before the seed came up, and lost but a single melon plant.

On one occasion, I captured, one morning, fifty-eight of all sizes under a single turnip leaf, and my son found fifteen at the root of a single small cabbage plant. But, even when the worms were as abundant as this would indicate, I found the process unsatisfactory and time-consuming, and resorted to my present effective plan of poisoning them.

After the land is prepared for cabbages, or any other crop needing protection, I place cabbage or turnip leaves in rows fifteen or twenty feet apart all over the field, and about the same distance apart in the rows. The leaves

are first dipped in a well-stirred mixture of a tablespoonful of Paris green to the bucket of water; or they may be first moistened, then dusted with a mixture of one part of Paris green to twenty of flour, and placed carefully with the dusted surface next to the ground. Two such applications, particularly in cloudy weather, at intervals of three or four days, will suffice to allow the cut-worms to make away with themselves, which they generally do with perfect success. This plan, of protecting the various crops, is the best that I have found. Whoever adopts it, will rid himself of the pest at least cost and trouble, and will not be compelled to replant constantly, or to sow his seed so thickly as to provide:

> "One for the black-bird, one for the crow,
> Two for the cut-worm and three to grow."

NATURAL ENEMIES OF CUT-WORMS.

In the front rank of all insectivorous birds as a destroyer of cut-worms stands prominently the much slandered crow. He is up early enough to catch the worm, before it descends; but, if need be, he digs it up. The good the crow accomplishes in killing cut-worms, tomato-worms, and field mice, far outweighs the value of the few grains of corn he may pilfer, and he should therefore be protected instead of being persecuted.

Domestic poultry are also useful aids in destroying cut-worms. The common mole, it is true, does considerable damage by burrowing between the roots of growing crops; but he is wrongfully accused of feeding upon grain, and roots of crops, for he is exclusively insectivorous, and he probably devours numbers of cut-worms. Fortunately for the mole, and for the farmer, too, attempts to poison it with corn soaked in strychnine are based upon the fallacious belief that he feeds upon the grain.

Notwithstanding the subterranean and nocturnal habit

of cut-worms they have several insect enemies, which attack them both above and below the surface. There are four-winged flies, belonging to the genus *Microgaster* which deposit their eggs in the body of the worms; and a large yellowish brown, four-winged Ichneumon fly, *Paniscus geminatus*, does the same. Among the insects that devour cut-worms for food, is the useful spined soldier-bug, and the larva and complete insect of the fiery ground-beetle, *Calosoma calidum*.

GRASSHOPPERS.

The insects commonly called grasshoppers, belong to two families of *Orthoptera*. The first and comparatively harmless (*Locustidæ*) are mostly nocturnal insects, generally green in color, with their legs four-jointed. They have long, tapering feelers, and are provided with a long projecting instrument at the end of the body for depositing their eggs (*ovipositor*).

The other family (*Acrididæ*), embraces the more destructive "hateful grasshopper," or Rocky Mountain locust, the locusts of the Bible (*Locusta migratoria*), and the numerous varieties, which are so destructive to our turnips and cabbage seedlings in autumn. (The insects, commonly called locusts in this country, belong to the *Cicada* family, and are harmless to the crops of the truck-farmer.) These are more varied in color than the foregoing, have shorter feelers, three-jointed legs, and no long egg-laying instrument. The female insect lays a large number of eggs in the soil, late in the fall, which hatch out in the spring. The larvæ are wingless, but otherwise bear a great resemblance to the imago and perfect their growth during the summer. To plants in seed-leaf they are very destructive; but those more advanced may outgrow their inroads. To plants so young, as only to have one or two seed-leaves, or still in the seed-bed, there can be no reasonable objections to the applica-

tion of poison for their protection, as all the first leaves will be cast off long before maturity, and the small amount that might lodge on the stem would be removed by rain.

Harris says that grasshoppers are attacked by certain thread-like, brown, or blackish worms (*Filaria*), and are infested by little red mites (*Ocypete*), of which ten or a dozen may be found adhering to the body beneath the wings.

Probably moles and ground beetles, and their larvæ may destroy the eggs, while the crow and a few other birds, and domestic poultry, feed upon the insect.

Grasshoppers might be captured, as in France and elsewhere, by means of cloth traps, drawn across the fields, but such methods, without concert of action among farmers, are useless, and the use of kerosene on sheet-iron pans drawn over the field as recommended in the First Report of the United States Entomological Commission is, by all odds, the most satisfactory.

Grasshoppers are not apt to fly far from harboring grass or weeds; I avail myself of this habit, and locate my cabbage-seed beds in the middle of an open field, generally undergoing preparation at the time for oats. If the grain is up simultaneously with the cabbages, the young blades, while affording food, will not be sufficiently thick to furnish a harbor around the beds.

CRICKETS (*Achetidæ.*)

Unlike the tree-cricket (*Œcanthus niveus*) which injures fruit trees, the several kinds of crickets depredating upon the crops of the truck-farmer live upon the ground, harboring under low herbage and grass. They pass the winter at the South in the egg and in the perfect state; the female laying numerous eggs in the ground at the approach of winter, which hatch out in the spring. They abound particularly near the sea coast, where, at

times, they become very destructive. Exclusive of cutworms, no insect here was more destructive to young cabbage plants in the fall of 1881. In March and April they gnaw into the "curds" of cauliflower, making unsightly blemishes.

They emit their shrill sound by rubbing their wing covers against each other. This insect, on very young plants, may be poisoned by an application of Paris green, but when it becomes dangerous to use the poison in this manner, it may be mixed with grated carrot.

Crickets have the habit of hiding under objects on the ground, and may be found under boards, palmetto leaves, etc., placed along the rows of cabbages and other crops, for the purpose of attracting them, but it requires quickness to kill them, with a flat bat, as they become very lively as soon as light is admitted to their retreat.

THE MOLE-CRICKET (*Gryllotalpa.*)

Owing to its exclusively nocturnal habit, this insect is rarely seen, although it is sometimes destructive to seedling plants, eating off the seed leaves, for instance, of melons and cucumbers. There are two species in this country. *Gryllotalpa borealis* is found in moist ground in the New England and other Northern States, but is much less common than *G. brevipennis* in the Middle and Southern States. A still different species, *G. vulgaris*, is found in Europe, where it is more abundant than either of ours are with us. It is often quite troublesome. I have seen it successfully captured by sinking empty tumblers, flower-pots (closed at the bottom), etc., level with the surface of the soil. It may also be poisoned in the same manner as the cricket.

BIRDS AS INSECT DESTROYERS.

As related to the question of the utility of insectivorous birds and their food supply, I cite the examinations

made by Prof. S. A. Forbes, of Illinois, of the stomachs of eighty-six blue birds (*Sialia sialis*), and his observations and conclusions.* Ten of the birds were shot in February, twenty-one in March, thirteen in April, nine in May, ten in June, nine in July, two in September, and twelve in December, in Southern Illinois. The stomach of a bird shot February 24th, contained thirty per cent. of cut-worms; forty per cent. of crickets; five per cent. of ichneumonidæ; twenty-five per cent. of the larvæ of the two-lined soldier-beetle. After enumerating the contents of the stomachs of all the birds, Prof. Forbes summarizes: "What now shall we say of the economic relations of this bird? According to the estimate of Mr. Walsh that (reasoning from the comparative numbers of injurious and beneficial insects, a bird must be shown to eat at least thirty times as many injurious individuals as beneficial ones, before it can be considered useful), the blue bird does at least twenty times as much harm as good,—that is to say, the beneficial insects destroyed would themselves have made away with twenty times as many injurious insects as the birds themselves have eaten. Admitting that Mr. Walsh's estimate was exaggerated, it surely was not twenty times too large, and even if it were, we could merely look upon the blue bird as harmless, indeed, but as useless also. And yet, in the face of this, I venture to doubt that a case has yet been made out.

"In the first place, nothing has been learned of the food of the young, and there is some reason for supposing that birds select for their young, the softer kinds of insects. This supposition, founded chiefly upon the statements of M. Florent-Prevost, of Paris, is contradicted, it is true, by observations of the food of the young mocking-bird, and whatever deficiency of credit may be due to this neglect of the food of the young, is compensated

* From the "American Entomologist," 1880.

in part, at least, by the fact, that the number of caterpillars eaten is doubtless overestimated, in comparison with hard insects, as their flexible skins remain in the stomachs of birds longer than the hard structures of insects. This is exactly contrary to the usual supposition, but the frequent occurrence of numbers of the emptied and twisted skins of cut-worms in the stomach, still recognizable as *Noctuidæ*, when not even a fragment of a single head remains, is sufficient evidence that the hard parts break up and disappear before these delicate but yielding skins. Secondly, while our knowledge of the food of arctians, cut-worms, and grasshoppers, is sufficiently definite and full to enable us to predict with certainty exactly what would happen, if those eaten by the blue birds were allowed to live and multiply, we have not the same complete and certain knowledge of the food and habits of the different genera of ichneumonidæ, the ground-beetles, the soldier-bugs and soldier-beetles. One hundred blue birds, at thirty insects each a day, would eat in six months about half a million insects. If this number of birds were destroyed, the result would be the preservation of about one hundred and seventy thousand caterpillars (ninety thousand of them cut-worms), twenty thousand leaf-chafers, ten thousand curculios, and eighty-five thousand crickets, locusts, and grasshoppers.

"How this horde of marauders would busy itself, if left undisturbed, no one can doubt. It would eat grass and clover, and corn and cabbages, inflicting an immense injury itself, and leaving a progeny which would multiply that injury indefinitely. On the other hand, would the two hundred thousand predaceous beetles and bugs, spiders and ichneumons, either prevent or counterbalance these injuries? I do not believe that we can say positively whether they would or not. In a discussion of the natural checks upon the cut-worm, Prof. Riley, in his First Report as State Entomologist of Missouri, men-

tions two species of ichneumon that parasitize the larva, credits the spined soldier-bug and the carabid larva, *Calosoma calidum*, with its destruction, and says that some kinds of spiders are known to prey upon it. From the Report of the United States Entomological Commission, for 1877, we learn that the grasshopper is preyed upon, at one or the other stage, by *Agonoderus*, *Harpalus*, *Amara*, and other carabids; by soldier-beetles, soldier-bugs, and spiders, and that certain ichneumonidæ parasitize the eggs. It seems probable, therefore, that the beneficial insects eaten by blue birds include the special enemies of the cut-worms and grasshoppers it destroys, but he who knows best the small number of reliable observations upon which our general statements of the food of predaceous insects rest, will have the most hesitation in trusting them without reserve. The probabilities seem to be against the blue bird, but the certainties are, as yet, in its favor. Finally, I would call attention to the fact that we do not know that the normal rate of increase among these carnivorous and parasitic insects is not sufficient to keep their numbers full to the limit of their food supply, and to furnish also a surplus for destruction by birds. Just as a tree puts forth more leaves than it needs, and sets more fruit than it can possibly mature; as an offset to the constant normal depredations of insects, so there is much reason to suppose that our insect friends have become adjusted to this steady drain on their numbers. There are many considerations involved here into which I can not at present enter. It will suffice to say that all the evidence we have of the increase and decrease of carnivorous insects, attendant upon the increase and decrease of the insects upon which they feed, tends to show that the real limit to their multiplication is not destruction by birds, but a deficient food supply, and that in relieving them from their feathered enemies, we should only be giving a por-

tion of them the poor privilege of starving to death, instead of being eaten up. Considering, therefore, the certainty of the evil consequences of the destruction of the blue bird, and the uncertainty of the possible good, I believe that, notwithstanding the apparent balance against the species, even the most radical economist, the most indifferent to the beauty and pleasure of the natural world, would have no present justification for throttling the song of the blue bird in his garden, with the hope of increasing thereby his annual store of hay and cabbage."

The following table gives the percentages of the three classes of insects destroyed, and the average for the season:

PERCENTAGES FOR EACH MONTH.	*February.*	*March.*	*April.*	*May.*	*June.*	*July.*	*December.*	*Average for the Species.*
Beneficial.....	46	28	21	35	38	14	11	28
Injurious.....	41	60	23	55	26	67	02	39
Neutral	13	11	56	10	34	19	87	33

CHAPTER XII.

ASPARAGUS.—(*Asparagus officinalis.*)

Asperge, French; *Spargel*, German; *Aspergie*, Dutch; *Asperago* or *Sparagio*, Italian; and *Esperrayo*, Spanish.

Asparagus is a native of the sea coasts of Europe, and has long been in cultivation as one of the choicest vegetables of the garden. Peter Henderson says of this vegetable, that the supply has never yet fully satisfied the demand, and that a small quantity of good asparagus has

frequently helped to sell a wagon load of vegetables, the gardener making its sale conditional upon the purchase of other articles. Asparagus is not only a wholesome article of food, but it is a pleasant diuretic and aperient, and is often used as an alterative or "purifier of the blood." When prescribed medicinally it is, as a decoction, made by boiling two ounces of the root in one quart of water. There are some sixty or seventy species of asparagus, of which the above named is the only edible one. While the shoots of the majority of the asparagus plants are green, some plants produce purple-topped shoots, owing probably to some modification of the leaf-green, or chlorophyll. Such plants cannot be considered even as varieties, as they occur in every planting of whatever kind of asparagus seed, and the peculiarity is not transmitted as a regular distinctive feature.

Difference of opinion exists among horticulturists in regard to the question of varieties of this vegetable, some contending there are no varieties of *Asparagus officinalis*. They claim that growers, in several localities, have brought the cultivation of asparagus to such a state of perfection, as to have developed a decided superiority in the plant; that, as like produces like, the seed of such plants are preferable and will continue to give a superior product. They hold that, until deteriorated, the Conover's Colossal, the Ulm, the Argenteuil, and others, are only improved strains, while others claim them to be distinct varieties. Unlike the varieties of other vegetables, the different sorts of asparagus are distinguished neither by shape, nor color of leaf or flower, nor by taste, nor by any other character, save size, and when removed from favorable conditions of climate, soil, manure, and management, they deteriorate and are undistinguishable from plants grown from seeds of the poorest kind. Asparagus is a dicœcious plant, that is, the male (staminate) and female (pistillate) flowers are on separate roots.

Only the latter bear seeds which will not be fertile unless the flower is impregnated by the pollen of the former. Thus it requires two distinct plants for the propagation of the species. Should a variety originate by chance, its flower would require the pollen of the previous variety to fertilize it; and to transmit its distinctive features to descendants, it must be ever afterwards exempt from any altering influences of the pollen. If such breeding of varieties was probable in dicœcious plants, the chances of cross-fertilization are such that varieties and sub-varieties would be constantly seen.

RAISING THE PLANTS.

Asparagus is propagated from seed, the usual practice being to raise the plants in a seed-bed, and transfer them to the field when one or two years old, those of one year being much the best. It has generally been, at the South, not only the uneconomical, but from an horticultural point of view, the objectionable custom to purchase the plants from Northern nurseries, at from four dollars to eight dollars per thousand, without any knowledge of their previous cultivation, age, or condition. This has been done when the plants could be grown much cheaper, and much better at home, with the additional advantage of being able to lift them carefully and fresh from the seed-bed when needed; whereas, procured from a distance, they are stale, roughly handled and bruised. The price of the seed is usually about fifty cents per pound, containing some fourteen thousand seeds, which should supply at least ten thousand five hundred plants, or enough for three acres. At the average price of plants, as offered by the largest seed firms, the same number of plants would cost twenty-one dollars. Small, spindling shoots are comparatively worthless. The asparagus grower should start his seed-bed with the ultimate object of producing large, stout sprouts, (or "grass," in the language

of the market), and to do this he must avoid stunted plants. A good asparagus plantation is expensive. It brings in no return for three years, but when it once comes into bearing, it remains productive for twenty years or more, and affords good profits. Unless it can be properly made from the start, it had better not be undertaken.

The seed of asparagus is not injured by frost. It may be sown from December 1st to the middle of March. Select high, sandy or well-drained, light land, which has been well manured; sow in drills two feet apart, and one inch deep; the plants should stand about three inches apart in the row. At these distances, one-fourth of an acre will grow twenty-one thousand seven hundred and eighty plants, or a sufficient number to plant five or six acres. If proper care is taken of them during their growth, the plants will be superior to any of one year's growth, purchasable at any price from any Northern nursery, simply in consequence of our longer and warmer growing season. In addition to this, are the advantages of being able in transplanting to return them to the soil, fresh and without injury to the roots.

THE SOIL AND ITS PREPARATION.

One of the chief claims of asparagus to popular favor is its early appearance in the spring; and hence, a heavy cold clay, particularly if badly drained, should be avoided. A light, high, warm, sandy soil, heavily fertilized, is best adapted to this crop, and it especially flourishes when such soil is located near its native habitat—the sea coast. The more manure, the better the cultivation, the larger and better will be the "grass;" therefore the land should be in fine, mellow condition before the application of the manure. After deep plowing, subsoiling, and harrowing, a coating of about a hundred wagon loads of green stable manure to the acre, without much long litter,

should be turned under as deeply as possible. Future surface manurings will benefit the top soil. The field being thoroughly harrowed, straight rows should be laid off with a two-horse plow, going only in one direction, care being taken to have the straight cuts, or land-sides of the furrows, equi-distant from each other, and five feet apart. If the roots of the plants are long, it will probably be necessary to deepen the furrows by following the first with a smaller plow. In the bottom of the furrow it is well to apply some lasting fertilizer, as coarse

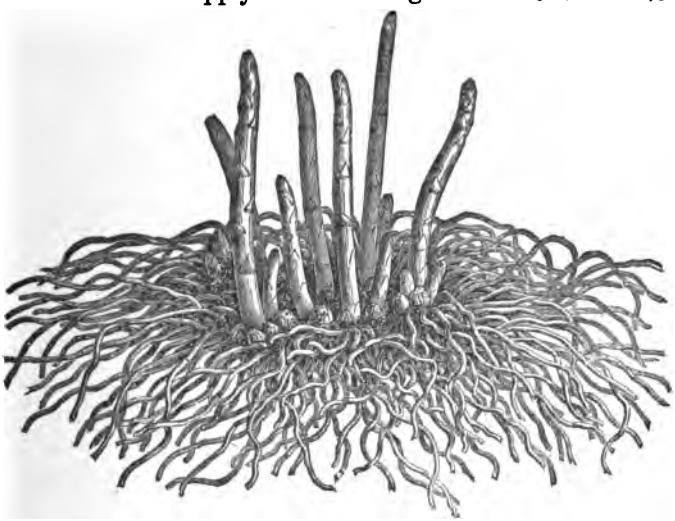


Fig. 15.—ASPARAGUS PLANT.

ground bone, at the rate of half a ton to the acre. If the land is high and warm, the crowns of the plants might eventually be about six inches below the surface; but in colder ground it would be unsafe to place them deeper than four inches, or the sprouts might be late in the spring, and a part of the plants might perish. The roots are round and succulent, with numerous small fibres, which unite to form the crown, from which the

sprouts appear. The crown grows laterally, the base of every succeeding bud, during the life of the plant, remaining at about the same depth. This lateral manner of growth, and the position of the buds, are shown in fig. 15. The deeper the plant can be placed, due regard being had to the requisites of an early and profitable growth, the better, as the crowns will be less liable to injury at the hands and knives of careless cutters of the crop. The old method of close planting of asparagus upon trenched ground, with a subterranean layer, three feet deep, of oyster shells, or brickbats, for drainage, and with the idea of preventing the too deep growth of the roots, has been abandoned. One might as well expect to see stalks of corn grow thirteen feet high, and thick in proportion, when the grain is sown broadcast for fodder, as to look for good "grass" from the old manner of planting.

An old asparagus plant makes an enormous growth of root, both as regards its mass and length, and wide planting admits of these roots securing a sufficiency of food, and of their making a vigorous growth without crowding.

SETTING OUT THE PLANTS.

The plants should be carefully lifted from the seed bed with a digging fork, without bruising the roots. These, if very long and irregular in length, may be shortened back a little.

The distances in the row being marked off at from two to two and a half feet, or even three feet, a plant is dropped at each place, and the planter, following, holds the plant at the proper depth, say six inches, against the land side, or cut, with the roots spread out from the crown in a fan-shaped manner, and, with a single sweep of the left hand, fixes it in position with loose soil from the top of the furrow. The subsequent filling in may be

done with the plow; but the hoe is to be preferred, as the depth can be more exactly adjusted, and there is less danger of an accidental disturbance of the plant. For safety, until growth commences, the crowns should not be covered the entire depth, but only two or three inches; when the shoots have grown several inches high, the covering may be completed, and this will serve as a working of the ground, and destroy weeds.

CULTIVATION.

Its vigorous growth enabling it to overtop grass, and to hold its own against weeds, asparagus will withstand as much neglect as any other vegetable; but it will respond to generous treatment. The expense of its first planting, and its care, until it commences to make a return two or three years later, are too great to admit of neglect. If the plantation has been properly made and properly tended, its rank and luxuriant growth will meet across the five-feet rows in the third year and smother most weeds during the summer. The crop should be cultivated and hoed as often as necessary to subdue grass and weeds. Asparagus produces seed the second year. As soon, therefore, as the stalks commence to die in the fall, they should be chopped down and burned, to prevent, so far as possible, the growth of young seedlings among the crop, which are not readily eradicated, and are really weeds.

It is useless to apply manure when the plant is at rest in the fall and winter, but just prior to the commencement of growth, make an application of half a ton to the acre of Peruvian guano, bone-flour, or ground fish guano, mixed with muck, woods-earth, or garden soil, and thoroughly harrow it in. If stable manure is used, it should remain upon the surface. The material being at hand, a mulch thick enough and close enough to prevent the growth of weeds and grass, to be burned off before the

winter top-dressing is to be applied, would obviate the necessity of frequent working, and of chopping, or mowing down the bushes, and would destroy all the seed, without causing any injury to the deeply buried roots. Subsequent cultivation consists in keeping down weeds by stirring the soil with cultivator and hoes, and in the annual installment of fertilizers, alternating each year with a different kind.

The natural habitat of asparagus being the sea coast, it is benefited by applications of common salt, which may be used with advantage in sufficient quantity to destroy weeds, say from six hundred to eight hundred pounds to the acre, particularly if the crop is at a distance from the sea shore. The burning of a mulch of marsh sedge would supply the crop with other salts of sea water besides common salt. If the shoots are numerous and strong, a few may be cut the third year, but it is better to defer cutting any until the fourth season from the seed.

CUTTING AND MARKETING.

Asparagus knives of various shapes are made expressly for the purpose. The blade should be passed down along the shoot to the necessary depth, when by a turn of the handle the shoot is severed, and can be lifted out.

Only the part of the shoot made green by exposure to light is eaten, the white blanched portion being tough and stringy. Yet fashion, and, therefore, the trade, demand that at least a part of the sprouts be white, otherwise it would not be necessary to place the crowns so deeply in the ground. A change in this respect is taking place, however, and a modification in the mode of planting may soon be advisable.

Asparagus should not be cut until the shoots are four or five, or even six inches above the ground, so that they may be at least eight inches long, that being the usual

length of the bunches. A plantation in full bearing and vigorous growth may require to be cut daily, but it should not be continued beyond about four weeks, for fear of weakening the plants.

The bunches, to command the highest market price, should be four inches in diameter, eight inches in length, and about two and a half pounds in weight, and should not only consist of good assorted "grass," but be evenly and compactly made. To attain these requisites, without too much loss of time, a buncher, of which there are many patterns, is indispensable. It holds the proper number of sprouts to form the four-inch bunch, firmly in position for one tie to be made below the buds and another near the base, when the lower ends may be evenly cut off with a sharp knife. The simplest form of buncher is shown in fig. 16. It consists of a board with four pins about six inches long, placed four inches apart, and forming a square. This is placed against a wall, in order to make the ends of the shoots even, or it may be provided with a back, as in fig. 16. The ties are laid down, and the shoots stacked up between the pins. A

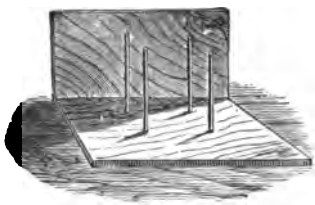


Fig. 16.—ASPARAGUS BUNCHER. (Old.)

Fig. 17.—ASPARAGUS BUNCHER. (Modern.)

more recent form of buncher is given in fig. 17. In this the shoots are placed between two strips of brass, and the upper, hinged portion brought down, which firmly holds the bunch in proper shape until it can be tied.

Twine and small willow twigs are sometimes used for ties, but Cuba Bast is the best material, and gives the bunches a very neat appearance. This is the inner bark of *Paritium elatum*, a large tree of the Mallow family. It is in large sheets, and sells, wholesale, at about $1.00 per pound. A recently introduced material, called Raffia, the outer skin or cuticle of the leaf of a palm, is very soft and strong, and may be used for the purpose. Either kind should be cut of the proper length and laid in water; this renders the material flexible, and allows the ties to be made more readily.

Asparagus is sold by the bunch, that from the South bringing generally, in New York, from nine dollars to twelve dollars per dozen, and it may be packed in other than the usual bushel crate, although a uniformity of package is desirable. The bunches should all stand upright, and if in more than one layer, the buds on top of the shoots in the lower one should be protected from being bruised by the stems of the layer above by some soft intervening material, like moss. The first cost of making a planting of asparagus with home-grown plants, as above, is about one hundred dollars per acre.

SAVING SEED.

Asparagus is one of the vegetables of which Southern-grown seed is as good as any. To save the seed, the ripe, red berries should be stripped off by hand, or the bushes cut down, and the berries threshed off. They are then placed in a vessel or barrel, and pounded with a wooden pestle to break the outer shells, which may be separated from the seed by washing, when the latter are dried in the sun and stored away.

INSECTS.

Asparagus is subject to injury from the following insects:

First—The asparagus-beetle (*Crioceris asparagi.*)

Second—The zebra-caterpillar (*Mamestra picta.*)

Third—The smeared-dagger (*Acronycta oblinita.*) A small ash-gray moth, the caterpillar of which sometimes feeds upon the plant.

The asparagus-beetle was introduced from Europe about 1860. In a few years it became so numerous and terribly destructive, that, in 1862, some farmers on

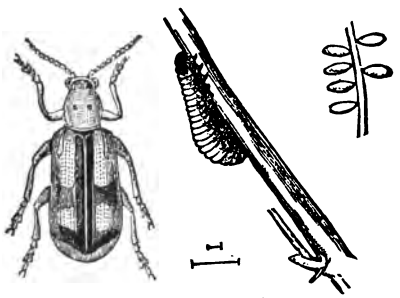


Fig. 18.—ASPARAGUS BEETLE (*Crioceris asparagi*).
Beetle, Larva, Egg. The lines show the natural length of Egg and Beetle.

Long Island plowed up their asparagus plantations, the crops having been ruined. All remedies failed, and it was thought the cultivation of asparagus would have to be abandoned on the Island, where the best in the country is grown. But in 1863, there appeared a deliverer in the form of a little black shining chalcid fly, which very soon checked the increase of the insects. The larvæ eat off the bark of the stalks, preferring, and commencing with, the tender shoots. The beetle has two broods in the season, and winters in the perfect state. I have never seen this insect at the South, but if it has not yet reached us, the probabilities are that it will do so in time.

The other insects named commit no serious injury.

CHAPTER XIII.

BEAN—BUSH OR SNAP.—(*Phaseolus vulgaris.*)

Haricot, French; *Schminkbohne*, German; *Heere Boon*, Dutch; *Fagiuolo*, Italian; *Fasoles*, Spanish.

The Bean is a tender annual, a native of India, and was introduced into England about 1590.

Owing to the ease with which it can be grown, the short period between seed-time and harvest (about six weeks), and its extensive consumption at the North, the bean is one of the principal vegetables grown by the truck-farmer. Its cultivation is most profitable where labor is plentiful for picking the crop, as in the neighborhood of cities.

VARIETIES.

There are two distinct forms, the Pole or Climbing Bean, and the Dwarf. The latter, *Phaseolus vulgaris*, is a low bush and produces its pods during a shorter time than the other. The Dwarf beans are a little more hardy, and the pods are smaller, but of better flavor and greater delicacy. As the running kinds require poles, the "Bush," in consequence of readier cultivation, is the bean of the market-gardener.

The varieties of Bush-beans are numerous. The flat-podded "Early Mohawk," is the earliest, and hardiest. It sells well, until the later, more tender and less stringy round beans come in, and command a higher price.

The "Valentine" is now the most popular round bean, it having superseded the "Refugee" or "1000 to 1," and the "Cleveland Extra Early" is considered the earliest of them, coming in about one week later than the "Mohawk." The several varieties of German "Wax-beans" are very

fine, and, when in good order, sell well; but they become spotted more readily, and are not so extensively planted as the others. The time for sowing may be, approximately, for the vicinity of Savannah, from the first to the middle of March, later to the northward, and earlier to the southward; in the middle of Florida, it may be safely planted as early as January 10th, and still further south, at any time in the winter. In 1881 the first beans from Florida came into the Savannah market on December 22d. Formerly vegetables regarded as out of season, could find no sale in the Northern markets, but now beans in limited quantities, bring fair prices in March.

SOIL.

The lightest land of the farm may be appropriated to the bean crop; but a sandy loam suits it best. Like other leguminous plants, it will grow fairly upon good soil without recent fertilization; though, like other market vegetables, it should be manured, and green, or fresh stable manure is considered most beneficial. The land being properly plowed and harrowed, straight furrows, if the land is level, are laid off, thirty inches apart. The manure is drilled from the tail of a cart, or with a manure distributor, at the rate of thirty wagon loads to the acre, then covered by the plow. The resulting ridge beds are leveled by means of a board attached to a plow beam, taking two at a time, or by hoe or rake.

To avoid repetitions, it may be stated here, that, for all vegetables hereafter to be treated, when manuring in the drill and planting on beds are mentioned, these operations of covering the manure and partly leveling the bed, must be understood to have preceded the putting in of the seed.

SOWING THE SEED.

The methods of depositing the seeds are various. One of the very best truckers in the vicinity of Savannah has

constructed an instrument for making holes, upon the previously raked beds, exactly an inch and a half deep, and three inches apart. Into these even his poorest hands may properly drop the beans. The implement consists of a wheel upon the periphery, or outer rim, to which are fixed pegs of the desired length and the proper distance apart. Another very successful farmer sows his beans by hand, in a wide furrow three inches deep, and covers them an inch and a half deep with a rake. The former claims a greater uniformity of showing above ground, a nicer appearance, a saving of seed, and greater facility in working the crop, as the hoe and cultivator may run close to the straight row. The other claims that his plants, in the wide furrow, come up in a sort of quincunx order, support each other, and that he gets more plants upon the same area. Others again open the drills by a hoe, or small bull-tongue plow and use a seed drill to sow the seed, and cover by rake, or board, or by means of the covering attachment with which the drill is provided. The drill must of course be arranged to work accurately and satisfactorily, when its use will prove the most expeditious and the cheapest method of planting.

CULTIVATION.

When the plants are three or four inches high, the cultivator may be run between the rows, and just before the buds appear, the plow and hoe should be used to land up or draw soil to the stems, a useful operation, and the last in the cultivation of the crop, which is, of course, only to be performed in dry weather.

PICKING AND PACKING.

The pods should be picked with great care, so as to cause as little disturbance of the roots as possible, and before the seeds become large enough to bulge out the pods, and while yet crisp enough to "snap"

when bent. Beans are apt to shrink in the package, and a little wilting prior to packing, in this case, is less objectionable. The beans should be laid regularly in the crate, well shaken down, and firmly packed. The crop lasts some three weeks, and about six pickings are usually made. A fair yield per acre, is one hundred and fifty crates, although more are sometimes made, and the prices range from one dollar to four dollars per crate, according to earliness and demand.

INSECTS.

Beans are such an early crop, and the pods are picked at such an early stage of growth, that the insects infesting them rarely damage the market-gardener's crop to any extent.

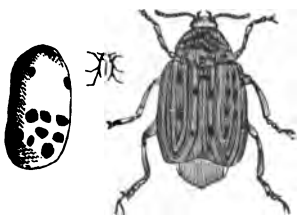


Fig. 19.—BEAN WEEVIL (*Bruchus fabæ*).

They are as follows:

First.—The Bean-weevil (*Bruchus fabæ.*)

Second.—The Yellow Bear Caterpillar, the larva of the Miller-moth (*Spilosoma Virginica*).

Third.—The Fall web-worm (*Hyphantria textor*).

Fourth.—The Blister-beetles, such as the Striped (*Lytta vittata*), the Ash-colored (*L. cinerea*), and the Margined Blister-beetles (*L. marginata*), which are, however, more hurtful to the Irish potato.

CHAPTER XIV.

BEET (*Beta vulgaris*).

Bettarave, French; *Rothe-Rübe*, German; *Biet* or *Kroot*, Dutch; *Barba Bettola*, Italian; *Bettarage*, Spanish.

The Beet is a biennial, tap-rooted plant, with somewhat fleshy leaves; it is a native of the sea coast of Southern Europe, and has been cultivated in England since 1656.

It is only within the past year or two, that the beet has been grown for shipment to any extent south of Norfolk, although it has for many years been one of the regular Bermuda crops. Next to the cabbage, this is one of the most extensively and profitably cultivated vegetables at the North, and it is probably destined to stand high in the estimation of the truck-farmer.

VARIETIES.

The turnip-rooted varieties are the earliest and best to grow at the South, and of these the "Egyptian" or "Red Egyptian Turnip" stands first, notwithstanding the seed is higher in price than any other sort. The "Early Blood Turnip" is next in value. The "Bassano" is the earliest variety, but objectionable in consequence of its turning a light color in boiling.

SOIL AND SOWING.

Beets, like the ruta-baga, may be sown for local markets in September and October; but in consequence of sudden changes of weather, success at this season is doubtful. Heavy rains and hot baking suns, whether the seed be up or not, may destroy a sowing. Although hardy, freezing will kill very young beets, and the

safest date for sowing near Savannah is about January 10th, and earlier or later, according to latitude. In middle Florida the beet may be sown through November and December. Like all tap-rooted plants, the beet delights in a deep, rich, loose soil, a low, but thoroughly drained, sandy mould being the best. If loamy, let the soil be deeply stirred, freed from clods and lumps, and made fine and mellow.

It is desirable to have clean and smooth roots, and fresh stable manure in the drill is objectionable, as it

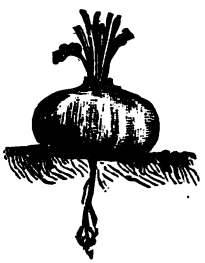


Fig. 20.—EGYPTIAN BEET.

Fig. 21.—EARLY BLOOD TURNIP BEET.

tends to make them branch or to produce "fingers and toes." Any rank manure in the drill, like night-soil, is objectionable, and hog manure is said to communicate an unpleasant flavor to the roots. Beets require a nitrogenous fertilizer, and well-rotted stable manure, thirty loads to the acre, broadcast, supplemented with five hundred pounds of Peruvian guano, or with three hundred pounds of nitrate of soda; or three-fourths of a ton of the guano, or half a ton of nitrate of soda, composted with muck, will suffice without the stable manure. But in this case, the land should have previously produced some well-manured crop. As this plant is a native of the sea shore, an application of twelve bushels of salt per acre is beneficial to crops distant from the coast. If the cultivation of the beet crop is to be entirely by hand, the seed may be sown

three-fourths of an inch, or one inch deep, with a hand drill in rows, fifteen to eighteen inches apart. On level ground sow in narrow "lands," say thirty feet wide, which will afford additional surface drainage. If the planting is to be on a large scale, the distance between the rows must be from thirty to thirty-six inches, according to the size of the cultivator. In sowing and weeding, bear in mind that each grain contains several seeds. Owing to its slow germination, beet seed is often soaked in warm water.—See chapter on "Seeds." The quantity of seed required to sow an acre is from four to eight pounds, according to the above-mentioned distances.

CULTIVATION.

The young plants should not be allowed to crowd each other. If the stand is close, it is well to chop out spaces in the row with a narrow hoe, and subsequently, when the plants are about two inches high, they should be thinned out to stand from four to six inches apart. Vacant spaces may be supplied; but transplanted turnip-rooted beets are not apt to make smooth roots. Subsequent cultivation consists in stirring the surface between the rows, working as near the beets as possible, and in keeping the crop free from weeds. Frequent hoeings between the narrow rows and some hand-weeding will be necessary. For the wider rows, one plowing, the use of the cultivator twice, and one hoeing may suffice in favorable seasons, but more should be given if needed.

MARKETING.

Beets must be marketed while tender, and before they are full grown. When about three inches in diameter, they are large enough for shipment. The leaves are cut off within about three inches of the roots, which, unwashed, are then to be closely and regularly packed in well-ventilated barrels, covered with cloth. The prices

of the past season ranged from two dollars per barrel upwards; as much as seven dollars and fifty cents having been secured for some marketed from middle Florida. The beet is, in this country, remarkably free from insect depredations.

CHAPTER XV.

CABBAGE (*Brassica oleracea*).

Chou pommé, or Cabas blanc, French; *Kopfkohl*, German; *Kool*, Dutch; *Cavolo*, Italian; *Berza*, Spanish.

The Cabbage was a favorite culinary vegetable of the Romans, who introduced its cultivation into England before the Christian era, although it grows wild along the sea shore of that country, particularly near Dover, where it is abundant on the chalk cliffs.

Cultivation has evolved from the wild plant very many sorts and varieties. Of these, the truck-farmer of the extreme South is at present concerned with only a few select varieties of the common or heading cabbage and with the cauliflower, kale being grown only at Norfolk and vicinity. Possibly the large German element in the populations of the Northern cities may in time provide a market for kohl rabi.

VARIETIES.

Climate affects the cabbage more, perhaps, than it does any other vegetable; and a variety growing, as to appearance, indifferently well in both countries, may be considered superior in England, and be discarded as worthless in America, while some sorts, which grow satisfactorily in one region, may fail in another not very distant.

A variety suitable for cultivation should (1) be sure to form heads; (2) produce medium to large heads; (3) the heads should be very hard and compact; and (4) it should be a popular kind in the majority of the principal markets.

Some varieties, like the "Schweinfurth," are bulky and delicate, but of such loose structure as to be useless for shipment, as they would shrink very much in the package. On the other hand, a barrel properly packed with a solid-headed variety, would shrink to a very limited

Fig. 22.—WINNINGSTADT.

extent in transit, and still be full upon arrival in market, to the satisfaction of the buyer. The two varieties that combine all desirable features in the highest degree, and at the same time are best adapted to our climate, are the "Early Summer" and the "Brunswick," with the preference for the former. It is somewhat smaller, but owing to its more compact habit of growth, a sufficiently larger number may be grown to the acre, to make up for the difference in individual size. The retail dealer will realize more money from a barrel of fine medium-sized cabbages, than from one containing a smaller number of very large heads. There is no better variety, if the seeds are of pure stock, for forming uniformly solid heads, than the "Jersey Wakefield," but it is small and liable to burst open when in vigorous growth in warm, rainy

weather following a drouth, particularly on high, sandy land. The remedy for this is "root-pruning," which is done by pushing the plants over slightly, to break some of the roots, or by cutting down alongside of

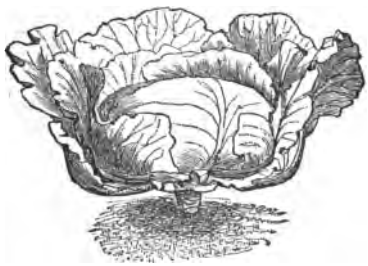


Fig. 23.—FOTTLER'S BRUNSWICK.

them with a spade. The Winningstadt, formerly so highly esteemed as a reliable, medium early kind, and even used as a winter sort, of late years appears to have degenerated, is liable to rot in the stem, and in warm weather its leaves turn yellow too readily. American seeds

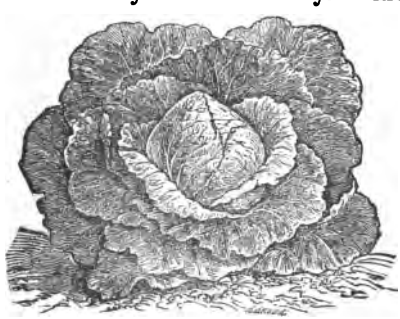


Fig. 24.—JERSEY WAKEFIELD.

are considered as producing more hardy plants than the imported; therefore, for a crop to head well in winter, the American "Flat Dutch" is the best variety, with "Fottler's Brunswick," which is an American variety of the German "Brunswick" cabbage, as second choice.

SEEDS AND SOWING.

Cabbages from imported seed are thought to be more certain to head, and in the vicinity of Savannah, those from Germany are preferred, however it may be in other localities.

It is of more importance to have seed of a good strain of the cabbage than of any other vegetable. Poor seeds of any of the genus Brassica are dear at any price.

In consequence of its good keeping qualities, the cabbage can be and is used in the United States throughout the year. The South is supplied with Northern grown stock during the hot summer months, and in the winter, the first shipments arriving about the middle of July. In turn, the North procures its supply from us after the exhaustion of the stores of wintered cabbages, dating from about March 1st, and continuing until June. Owing to its universal consumption, the markets have never yet been glutted with cabbage. Were its use less universal, as the Florida, Georgia, and Carolina crops are all marketed during the same period, the price might fall below a paying standard. The opening of the western and north-western markets for the less perishable articles of the truck-farmer, by lower railroad freights and safer transportation facilities, makes it probable that many years will elapse before sufficient areas are appropriated to the cultivation of such vegetables, as to cause the supply to exceed the demand. Cabbages are also grown to supply other than the Northern markets, of which we will speak hereafter. The seed to produce plants for the more important shipping crop is best sown between October 1st and 15th. It may be sown later; but as the plants are subjected to severely cold weather in December, it is important that they be large enough at that time to withstand hard frosts. When the thermometer falls below twenty-four degrees, they are likely to be killed.

To secure the necessary hardiness, and low, stocky growth, the seed should be sown thinly on rather light, unmanured soil. Instead of making a sowing in the open air later than November 1st, the careful gardener will provide against losses by frost, by sowing under glass in cold frames, about November 1st. The cold frame plants will only be used in case those in the open ground have been killed or injured by freezing, or have grown too large to be transplanted for a later crop. To render the plants as hardy as possible, the soil of the frames should not be manured, and it should be kept as dry as the health of the plants will permit. Sashes must not be used, day or night, to force the plants, but are only to be put on at night for protection against apprehended black frost.

For the location of a cabbage seed bed in the open air, see chapter on "Insects." A deep and freshly stirred soil is not indispensable to produce good plants, and, where moles are numerous, they are very apt to haunt a bed freshly stirred, and destroy many young plants. The bed may be thrown up by the plow a fortnight or more before the seed is to be sown. When it is raked off later, many young weeds, which might have become annoying, will be destroyed.

The seed bed should be about four feet wide, level on top, to avoid washing by heavy rains, and elevated a few inches above the general surface. The seed is sown from one-fourth to one-half an inch deep, according to the character of the soil. Make the drills across the bed four to five inches apart, to allow the earth to be stirred between the rows, firming the soil by the roller or by a patting board. When sown under glass, the drills may be three and a half inches apart. If the soil is dry, the beds may require watering to cause the seed to germinate. It is not advisable to sow any seed within two or three inches of the back of the frame, or the plants will

grow spindling from the effects of the heat reflected from the boards. Do not sow as thickly near the front as in the middle of the bed, lest in wet weather the plants may damp off while young.

At the South, at the planting season, so many contingencies affect the sprouting of the seed and the safety of the young plants, when placed in the open air, that no definite quantity of seed, which will suffice for a given area, can be stated. Among these adverse influences are hot baking suns, heavy rains, cut-worms, grass-worms (*Laphrygma frugiperda*), and grasshoppers.

Peter Henderson, one of the best authorities on market gardening at the North, says an ounce of seed will produce two thousand plants—there are about ten thousand cabbage seeds in an ounce—and A. S. Fuller, another good authority, estimates that an acre will require from a pound to a pound and a half of seed, or from one hundred and sixty thousand to two hundred and forty thousand seeds. I have sown pounds of seed without getting even a single plant. The only advice to be given is: to make frequent sowings and on different parts of the farm, and to follow the suggestion in the chapter on "Insects." If the seed is sound and properly sown under glass and cared for, few will fail to furnish available plants.

SOIL AND ITS PREPARATION.

The land best adapted to raise spring cabbages for shipment, is a moist, sandy loam, if well drained. Any good garden soil, properly enriched and well prepared, will answer, however, if it be not too light and sandy; on such soils the plants may be affected by the hot suns in March and April, just at the heading season. A newly cleared, well-drained mould is excellent. The chalk cliffs of the English sea shore being the native habitat of the cabbage, admirable crops of superior quality may be produced near

our coast under the influence of the moist sea air, wherever the soil is adapted to this plant. Lime is very beneficial to the whole cabbage family, and soil, otherwise of desirable quality, on the immediate sea coast of the mainland, or on any of the Sea Islands, if well supplied with crumbling oyster-shells, the rubbish of Indian camps, cannot be surpassed for this vegetable. That these accumulations of oyster shells, with a few shells of the clam and conch, are of Indian origin, is proven by the frequent occurrence among them of pieces of Indian pottery.

Heavy soils require to be more deeply stirred by the turning and the subsoil plows, and more frequently harrowed, than those of lighter character.

At the North, land consecutively cropped with cabbages seems to become infested with the cause, whatever it may be, of the disease of the root called "clubfoot;" an additional reason for rotation in cabbage culture. This appears to be less the case, when the land is plentifully supplied with lime naturally, or when it is used as a manurial application. Although the cabbage is little affected with this disease at the South, it is not well to have cabbages follow cabbages on the same ground.

The richer the manuring, in excess of what any possible crop could be able to take from the soil, and the better the preparation, the larger will not only be the individual heads, and, therefore, the weight of the entire produce, but the more certainty will there be of the whole crop heading up uniformly.

The table opposite shows the composition of fifty tons—equal to eighty-eight wagon loads of loose stable manure, holding thirty bushels, or one thousand one hundred and twenty-five pounds, each; and that of a crop of twenty-five tons of cabbages, both according to the analyses of Prof. E. Wolff.

	50 Tons of fresh Stable Manure contain	25 Tons of Cabbages contain
Nitrogen	546 lbs.	120 lbs.
Potash	520 "	315 "
Phosphoric acid	280 "	70 "
Soda	100 "	45 "
Lime	210 "	155 "
Magnesia	140 "	30 "

A study of the above table will show:

First.—That a crop of twenty-five tons of cabbages will exhaust within fifty-five pounds all the lime contained in an application of fifty tons of stable manure, and, if only that quantity were applied, an English or Northern yield of fifty tons, not an excessive estimate, under their closer planting, would require one hundred pounds more of lime than is contained in the manure. As was stated before, nearly all land holds sufficient lime for ordinary crops; but, unless the soil is rich in this component (often the case on the coast), land used for cabbage crops would be benefited by a dressing of lime, of about thirty bushels to the acre, every three or four years. It is not only a chief constituent of the crop, but it renders the nitrogen in the soil more available.

Second.—That exceedingly rich land is required for a good crop of cabbages; therefore, as no crop can take up all the nitrogen and other plant food contained in an application of manure, the larger the amount of this plant food and the greater its concentration and availability, the more satisfactory will be the result.

Third.—That if the stable manure used is deficient in liquid excrement, or has been exposed to leaching rains, fifty tons should be supplemented either with good Peruvian guano, or with nitrate of soda and an acid phosphate, or with night-soil. If stable, or any other bulky or composted manure is to be used, it is best to apply it broadcast for cabbage, after the land has been thoroughly pre-

pared by plow and harrow, and then to turn it into beds with a one-horse plow.

For applying bulky manures, either broadcast or in drill, for cabbages, Irish potatoes, or other crops, the truck-farmers who plant in the vicinity of Savannah on an extensive scale use a manure-spreader. This applies the manure not only evenly at a certain rate, which is very well regulated, but it cuts up and mixes the manure during the distribution. Of stable manure accumulated under shelter and well-rotted without having been fire-fanged, forty two-horse wagon loads to the acre on good land, which has previously been fertilized for a vegetable crop, is a fair manuring. If of less valuable quality, the quantity should be increased, or its character improved by adding guano, etc., as above recommended. Instead of stable manure, a good compost applied in quantity proportionate to its quality, may be used. This may consist of Peruvian guano, or some reliable ammoniated superphosphate of lime (acid phosphate), or of cotton seed, or night-soil, composted with muck or leaf-mould. If there be a specific manure for cabbage, it is good, pure, fine bone-flour.

Of the crops raised by the truck-farmer, there are one or two of which I may claim, without egotism, to have produced stock of superior quality. Among these are the two members of the Brassica genus, cultivated under this latitude for the Northern markets. Being situated too distant from the city to procure a satisfactory supply of stable manure, I cannot too urgently impress upon my fellow-farmers, similarly situated, the indispensability of plowing under the "Clover of the South," our cow pea, for successful cabbage culture, and indeed, although perhaps in less degree, for the growing of any other crop. It should precede for them every other application of manure for cabbages. Soda and potash are interchangeable in the composition of plants. Thus a plant

grown on a soil rich in the former, but poor in the latter, will contain much more soda than potash, and vice versa. The large preponderance of soda in the following analysis of the cow pea is attributable to the fact, that it grew upon soil near Chapel Hill, N. C., which, in dry weather, is sometimes coated white with carbonate of soda.

TABLE SHOWING THE COMPARATIVE FERTILIZING VALUE OF COW PEA VINES AND RED CLOVER.

	Potash.	*Soda.*	*Magnesia.*	*Lime.*	*Phosphoric Acid.*	*Sulphuric Acid.*	*Silica.*	*Chlorine.*	*Ammonia.*
Cow pea vines.....	10.88	17.13	4.96	16.58	6.84	1.68	0.70	0.14	13.20
Red clover, ripe....	23.21	1.07	8.21	22.85	6.66	2.02	1.78	2.50	32.60

Doubtless fine cabbages may be raised directly from the seed sown in place, instead of raising the plants in a seed-bed and then transplanting them. Experience and theory have long since shown the expediency of transferring the plants from the seed-bed to the open ground. By the former practice, nothing is gained and something is lost. Apart from the advantages of transplanting—(see chapter on that subject), we have, on a very small area, say one hundred and fifty square feet, a sufficient number of plants to set an acre. With at least one working in the first six weeks, of the land to which the plants are transferred, we avoid the possible damage to the soil, during six weeks of fall weather, by heavy packing rains, and we place the manure fresh and concentrated around the newly-formed roots, when the plant has sufficiently advanced in growth to make use of it.

TRANSPLANTING.

Cabbages in our southern climates are marketable, though not full-grown, in about five months from the seed, the time depending upon the degree of moisture and

the warmth of the season. Plants, if large enough, may be put out about November 1st, and successively, whenever circumstances are favorable, until January 1st. After this date, successful marketing will be more doubtful, although in case of loss by freezing, well-grown, sturdy plants, put out up to February 1st, as far north as Savannah, may come in early enough to anticipate the Norfolk crop.

When a plant is pulled from the seed-bed, the tap-root will probably be so shortened as to encourage the emission of numerous new fibrous roots. If not, its extremity should be pinched off. If the roots are puddled, they are more apt to take root promptly. This is done by making a mush or mud of clay, fresh cow dung and water, or of clay, or soil and some weak solution of any fertilizer, stirring it up to form a mixture as thick as cream. The roots of the plants are to be dipped in this, and if the plants are kept in the shade for twenty-four hours, young rootlets will commence to grow; but the plants must not be exposed to dryness, until the roots are in the soil. Puddling is not a necessary operation.

Should a drouth prevail during the whole proper transplanting season, watering during the process may be indispensable on very light soil. In such rare contingency a weak liquid manure is better than pure water.

The stems of all the plants of the Brassica genus are the most vulnerable part; to protect these from frost, to place the extremity of the root nearer to moisture, to encourage the formation of roots along the inserted stem, and finally, to secure the plant more firmly in the soil, it should be planted down to the stalk of the uppermost leaf, or very nearly to the crown of the plant.

Though occasionally planted closer together, the proper distance for Winningstadt, and other compactly-growing varieties, is eighteen inches in the row, and for the Brunswick, and other large kinds, from twenty-one to

twenty-four inches, the beds, or rows, being three and a half and four feet apart respectively.

CULTIVATION.

Plants cultivated, like the cabbage, for their foliage, should be pushed by frequent stirring of the soil. No vegetable responds more promptly to generous treatment than this. As soon as the plants commence to grow, the rows may be barred off by the plow to loosen the soil, but it must by no means be deferred late enough to stunt them by injuring the roots. (See chapter on "Insects"). Under ordinary circumstances, two or three plowings, exclusive of the above, the return of the soil to the beds, and a couple of hoeings may be sufficient for this crop.

In garden culture, and on a small scale, it is recommended to hoe every few days, and only while the dew is on; but the truck-farmer cannot make a hobby of his cabbage field to the neglect of other crops, however valuable this particular one may be.

GATHERING THE CROP AND MARKETING.

The Northern demand generally commences early in March, and the crop should then be in full heading to meet it.

Judgment and experience are needed to cut cabbages properly. Before its maturity, a head may be soft, that a little later will become hard and compact. Although a matured head presents a peculiar appearance, recognizable by an experienced grower, in part by becoming paler on top, it should be grasped and felt with the left hand, before the hatchet (which, with a little longer handle than usual, is the best cutting tool,) is applied. In preparing the heads for market, only a few outer leaves should be left to protect them from bruising in the package and, for the same reason, the stems should be trimmed close to the heads.

By comparing the valuable organic matter contained in clover, cabbage, and turnips, it will be seen that the cabbage outranks the latter as food for cattle.

	Water.	Albuminoids, or Flesh-formers.	Carbo-hydrates, or Fat-formers.	Fat.	Crude Fibre.
Clover	80	3.3	7.7	0.7	4.5
Cabbage	90	1.5	6.3	0.4	2.0
Turnip	92	1.1	5.1	0.1	1.0

The best use, therefore, to make of the waste leaves, is to feed them to stock. Unless so utilized, the heads had better be cut out so that very little subsequent trimming may be required, and the leaves and stalks plowed under, instead of allowing them to grow, to the detriment of the land. The refuse, if preferred, may be conveyed to the compost heap, which should be at some distance from human habitation. By the use of sufficient covering material, soil, or muck, the offensive gases (phosphoretted and sulphuretted hydrogen) may be absorbed, With such bulky crops as the cabbage, packing should be done near the field. During the cooler morning hours and cloudy weather, it may proceed in the open air, but during hot sunshine, it were better under shelter, for fear of subsequent heating in the packages.

Crates should only be used when barrels cannot be had, the latter being preferred by the trade. They must be properly ventilated, however, by six holes in the sides. They are not double headed, but are covered with cloth, the contents generally bulging about six inches above the top.

Whatever package is used, the cabbage should be evenly and firmly packed, using considerable force, so that no displacements and consequent bruising may occur during transportation. Each variety should be marketed in separate packages, and it is well, even with

cabbages, to assort the sizes, although this is not generally done. A barrel will contain from eighteen large Brunswicks to fifty of the Winningstadt, as small as should be shipped, although smaller will sell. An equal crop of the two varieties will average seven thousand two hundred and sixty plants per acre. With reliable seed, and under favorable circumstances, six thousand eight hundred of these should produce marketable heads.

From one hundred and seventy to two hundred barrels per acre is a good crop. One of the most successful gardeners near Savannah marketed one thousand seven hundred barrels from eight acres, which averaged, in the Northern markets, four dollars per barrel gross. His crop, closely planted, was manured with forty two-horse-wagon loads of unsheltered stable manure and night-soil, supplemented with Peruvian guano.

My own shipments last year averaged four dollars and fifty-three cents, principally in the New York and Boston markets. This may have been due to better sales rather than to the superior quality of the cabbages, and good packing may have had something to do with it.

It must, however, be stated that prices ruled unprecedentedly high during the season of 1882.

Freights from Savannah to New York and Boston were fifty cents per barrel. Commissions on sales were from seven to eight per cent.

Near Norfolk a local variety of cabbage is cultivated, known as "Tait's Extra Early." The seeds of this are sown about the last of August, the crop is transplanted in November, and is ready for market about April 1st. Jersey Wakefield, and Large York, sown about Sept. 20th, and set out in early winter, will come in about the same time. Seeds of the last two kinds, if sown for the main crop, under glass in October, and the plants put out in February, will come in later, but produce much the best cabbages.

During a glut in the markets, Norfolk cabbages may not pay the freight. The maximum price is three dollars and a quarter per barrel.

It is probably owing to the fact that larger varieties are grown near Charleston and Savannah, that the early arrivals from Norfolk do not seriously affect the prices of shipments made at the same time from more southern and distant points.

The cabbage crop is marketed early enough to be followed by a planting of corn, to be succeeded in turn by fall turnips; or the land may be used for a second crop of Irish potatoes, in which the manure would be available. Such is the management of the spring cabbage crop for the Northern markets. The period during which the truck-farmer markets his crops for shipment, is confined to the five months from March to July inclusive. Owing to the great number of small patches of all kinds of common vegetables, owned by negroes and whites near the city, the supply is so well up to the demand, that the majority of truck-farmers have found it unprofitable to attend the regular local market. If confined exclusively to the Northern, and the local sales of vegetables, the growers would have no income during seven months of the year; hence on the lines of the railroads truck-farming is generally an adjunct to cotton planting, and in Florida to that and to orange growing. Cabbage is one of the few vegetables that may be made available for the markets of the interior, where there arises a demand during the later winter months. The variety best adapted to this season is the more hardy American "Flat Dutch." Seed for this crop may be sown from June to September; but the earlier the better, as cabbage to head in time for the winter crop should "bud," or commence to head, before cold weather. Owing to hot suns and heavy rains, and destructive insects, it is difficult to raise the plants. The soil for the seed-bed may be

richer than for the later crop. Although cabbage requires an open exposure, the seed-bed may be under the partial shade of trees, but not near enough to be under their drip. If the seed-bed is protected by a screen, it should be high enough (seven to eight feet) and open enough to admit air and light. A mat made of our common large cane admits of removal occasionally, and the thickening of the stem at the joints prevents the total exclusion of air and light. The plants for this crop are generally put out from August to the middle of October. There is no material difference in the management of the two crops. Cabbages are shipped in grain sacks or barrels to the West and the upper interior cities of Georgia. The prices in Atlanta were from two and a half to five cents per pound, at wholesale, for the crop of 1882.

It is now impossible to say what were the insect enemies of the cabbage in the country where it was indigenous, and before its succulence and delicacy had increased and its cultivation had extended over so large a part of the globe. We have imported two of its pests: the Rape-butterfly and the Cabbage plant-louse from Europe, and may in turn export some of our native plagues to other countries. The cabbage is certainly more infested by destructive insects than any other cultivated vegetable. Those to the attacks of which it is subject at the South, are:

1. The Wavy-striped Flea-beetle (*Haltica striolata*).
2. The 12-spotted Squash-beetle (*Diabrotica 12-punc-*
3. The Cabbage Maggot (*Anthomya brassicæ*). [*tata*).
4. The Cabbage Plusia (*Plusia brassicæ*).
5. The Rape Butterfly (*Pieris rapæ*).
6. The Pot-herb Butterfly (*Pieris oleracea*).
7. The Southern Cabbage Butterfly (*Pieris Protodice*).
8. The Zebra Caterpillar (*Mamestra picta*).
9. The Cabbage Pionea (*Pionea rimosalis*).
10. The Cabbage Plant-louse (*Aphis brassicæ*).
11. The Harlequin Bug (*Strachia histrionica*).

12. The Tarnished Plant-bug (*Capsus oblineatus*).
13. The False Chinch-Bug (*Nysius destructor.*)

FLEA-BEETLE.

The first in order to attack the plant in its earliest growth, and before the appearance of rough leaves, is the Flea-beetle in the perfect state. Lime or soot, dusted on the young plants, while wet with dew, seems distasteful enough to the insect to drive it off. The larva also injures the roots of larger cabbage plants.

12-SPOTTED SQUASH-BEETLE.

Only within the last three years has the 12-spotted Squash-beetle been injurious to the cabbage crop. The perfect insect appears in February, puncturing and eating the leaves. Although sometimes considerable damage has been done, it has not been sufficient to compel a resort to Paris green.

CABBAGE MAGGOT.

The Cabbage-fly, or perfect insect of the Cabbage Maggot, was imported from Europe about 1856, but its depredations have until recently been confined to the North. The "Club-root," a warty enlargement of the roots, has been ascribed to this insect, but I have never seen it at the South. The Cabbage Maggot had not been observed to be injnrious to the crop until after the publication of the first edition of this book, but since then it has become the most destructive of the many insect pests of the cabbage, ruining large fields in South Carolina during the spring of 1885, and in Georgia during that of 1886 so completely, that farmers plowed them up for other crops. When a plant shows signs of the presence of the insect by a sickly appearance, it is already past remedy. The fly deposits its egg on the plant at or

near the surface of the ground, and the maggot hatching, eats away its bark and penetrates the stem.

Half a teaspoonful of bi-sulphide of carbon to each plant, poured into a hole made by a stick at the root, will kill the maggots, after which a healthy plant may be substituted. The vapor of the bi-sulphide of carbon is highly inflammable. A simpler and safer remedy is kerosene emulsion.

The insect is strictly confined to plants of the Cabbage

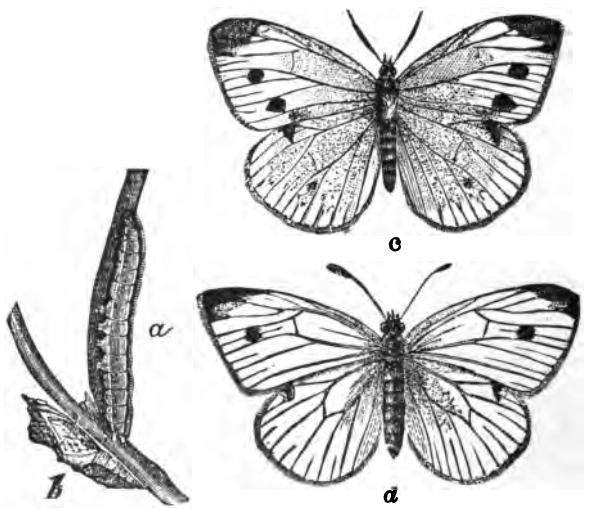


Fig. 26.—RAPE BUTTERFLY (*Pieris rapæ*).
a, Larva; *b*, Chrysalis; *c*, Female; *d*, Male.

family, and isolated farms may be kept comparatively exempt by having no winter crops of any of its members.

The most destructive green cabbage-worm at the South, is the looping, or half measuring, larva of the night-flying, or noctuid moth, the Cabbage Plusia (*Plusia brassicæ*). All cabbage growers know how these with the help of some others, honey-comb cabbages in the spring.

LIGHT-COLORED CABBAGE-WORMS.

The following three, viz., the Rape Butterfly (*Pieris rapæ*), the Pot-herb Butterfly (*P. oleracea*), and the Southern Cabbage-Butterfly (*P. Protodice*), are white or cream-colored butterflies. The first two are more numerous and destructive than the third, our native Southern species. The larvæ and butterflies bear a general resemblance to each other, though they differ in their markings, as will be seen by an examination of the engravings.

All of these cabbage-worms have their insect enemies. The Pot-herb Butterfly has lately been kept in check by

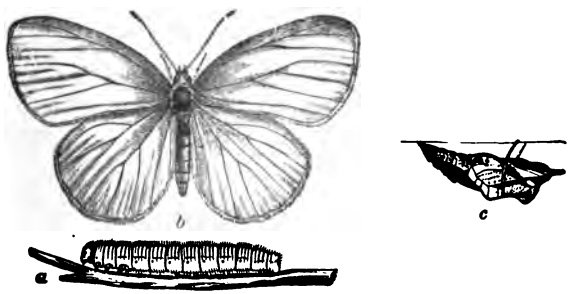


Fig. 27.—POT-HERB BUTTERFLY (*Pieris oleræca*).
a, Larva; *b*, Butterfly; *c*, Chrysalis.

its own appropriate parasite (*Pteromalus puparum*), a little greenish wasp-like insect, less than one-tenth of an inch in length, with four delicate transparent wings. These butterflies almost invariably deposit their eggs on the under surface of the leaves. They hibernate generally in the chrysalis state, attaching themselves to fences, stems of bushes, etc., in the vicinity.

If boards were fixed in the cabbage field, about two inches above the ground, these worms would probably resort to them, but such methods to capture them and diminish their number, after the infliction of the dam-

age, particularly on a large scale, and without coöperation, would be impracticable.

The Zebra Caterpillar (*Mamestra picta,*) is not suffi-

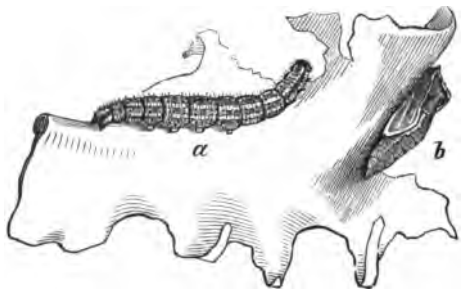


Fig. 28.—SOUTHERN CABBAGE BUTTERFLY (*Pieris Protodice*).
a, Larva; *b*, Chrysalis.

ciently numerous to do much harm. The Cabbage Pionea (*P. rimosalis,*) I have never found upon the cabbage.

REMEDIES FOR CABBAGE-WORMS.

The numerous deterrent remedies recommended as effective against the cabbage-worms, although many may

Fig. 29.—SOUTHERN CABBAGE BUTTERFLY—Female.

be distasteful or offensive to them, are all comparatively worthless. This is owing partly to the impossibility of their being made to reach every part of the plant haunted by the insect, particularly the under surface of the leaf, and the interior of the head. Among the proposed

remedies are: red pepper, soot, lime, ashes, salt, sulphur, solution of copperas, yeast, soap-suds, etc. Water heated to one hundred and forty, or even to one hundred and sixty degrees, was at one time highly praised as an insecticide; but the same objection applies to it as to the others. Were it not hazardous to apply to the eatable portions of vegetables, like the cabbage, etc., poisons dangerous to man, we would have an effective means in Paris green or London purple for the removal of these insects.

The remedy for cabbage-worms, tested and recom-

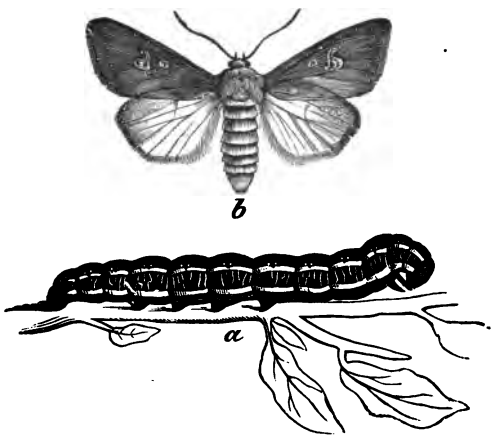


Fig. 30.—ZEBRA CATERPILLAR (*Mamestra picta*).
a, Larva; *b*, Moth.

mended by our best authority on such matters, Prof. Riley, is Pyrethrum powder. This is also called "Dalmatian," or "Persian Insect Powder," and the name "California Buhach," is given to the fresher and therefore more effective Californian product. This is not a mere deterrent, rendering the part of the plant it touches obnoxious to the worm, but it acts as a poison by contact, convulsing and paralyzing the insect. While this powder is very effective with some kinds of insects, it is

comparatively harmless to others, and is more effective on young worms than on older ones of the same species. It is more fatal to the caterpillars of Pieris butterflies than to those of the Plusia moth. The powder does not always kill the worm, but merely so disables it that it falls to the ground, where it will readily become the prey of ants and other natural enemies.

Pyrethrum seems to owe its virtues to a volatile oil, and its effects are not lasting in the open air. It may be used in the form of dry powder, mixed, if fresh, with from ten to twenty parts of flour, and blown by means of a bellows, or dusted upon the plant. It may also be used in the form of an alcoholic tincture, as a tea or decoction, or even a mere solution or infusion in water, and applied by means of an atomizer or sprinkler. The fumes of burning Pyrethrum are applicable only in greenhouses or in dwelling rooms, which may be cleared of flies and mosquitoes by its use.

PLANT-LICE.

The astounding fecundity of plant-lice (*Aphides*), and their peculiar habit of attacking stunted plants, have already been mentioned. If the season be not too far advanced, or the plants too large, a badly infested cabbage should be pulled up, removed from the field, and its place supplied by a clean and healthy one.

The same valueless applications, with the addition of tobacco water and snuff (tobacco smoke in greenhouses), as in the case of the cabbage-worms, have been also recommended for plant-lice. Pyrethrum may be better than any other, but it would be useless to apply remedies to a large, badly infested cabbage, in the hope that it would ever become marketable. If of any effect, its application might destroy some plant-lice, but I have never carefully examined an infested plant without finding some of the natural enemies of the aphides at work

among them, and, if left alone, the lice would eventually succumb. An effective application would probably destroy friend as well as foe. My only success in fighting plant-lice was by transferring the larvæ of the lady-bird from less valuable ruta bagas to cauliflowers or cabbages.

The best advice in the premises is: prepare the land thoroughly, manure it richly, and cultivate the crop frequently and carefully, thus securing such vigorous and luxuriant growth that the losses by cabbage-lice will be insignificant.

INSECT ENEMIES OF PLANT-LICE.

The insect enemies of the plant-lice are legion, else they would devour every green living thing upon the earth. Some of these enemies are enumerated below. One or two of the species of lady-birds may be confined to other plant-lice than the *Aphis brassicæ*. The lady-birds, both in the perfect and larval state, feed upon little else than plant-lice. Of these there are:

First.—The Nine-spotted Lady-bird (*Coccinella 9-notata*). Nearly round, brick-red, with nine black spots.

Second.—The Two-spotted Lady-bird (*Coccinella bipunctata*). Similar to No. 1, smaller, with two black spots.

Third.—The Spotted Lady-bird (*Megilla maculata*). Imported from Europe. Pink, with large black spots.

Fourth.—The Thirteen-spotted Lady-bird (*Hippodamia 13-punctata*) Brick-red, with thirteen black spots.

Fifth.—The Trim Lady-bird (*Cycloneda sanguinea*). It has no black spots.

Sixth.—The Convergent Lady-bird (*Hippodamia convergens*). Deep orange-red, marked with black and white.

Seventh.—The Fifteen-spotted Mysia (*Mysia 15-punctata*). From light gray to chestnut-brown, with fifteen black spots.

Eighth.—The Twice-stabbed Lady-bird (*Chilocorus bivulnerus*). Highly polished black, with two red spots.

Besides these, there are many less common kinds.

Prominent among the enemies of the plant-lice are the larvæ of the Golden-eyed and Lace-winged flies, called Aphis-lions.

Other enemies are the larvæ of Syrphus-flies, somewhat resembling a leech in shape. Besides being preyed upon by all these insects, the plant-lice are subject to several genera of tiny parasites included in the genus *Aphidius*.

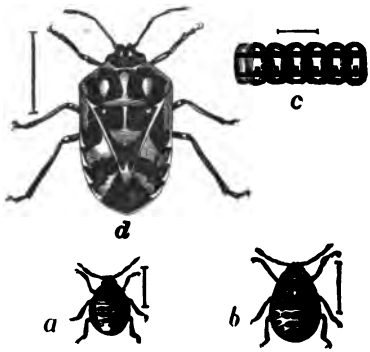


Fig. 31.—HARLEQUIN CABBAGE BUG (*Strachia histrionica*).
a, Larva; *b*, Pupa; *c*, Eggs; *d*, Perfect Bug.

They have mostly black bodies, and are about one-twentieth of an inch in length. The little round, plump, smooth bodies in a colony of aphides, or remaining on the leaf of a plant after the removal of the colony by other enemies, are dead parasitized aphides containing the parasitic pupa of an ichneumon fly.

The Harlequin-bug made its appearance in Georgia, from Mexico, about the commencement of Mr. Lincoln's first presidency, from which circumstances it received the local name of "Lincoln-bug," by which it is still known in Southern Georgia. In 1867 it had reached North Carolina.

This insect winters in its perfect state, and the first

that are seen in spring should always be destroyed. The larvæ puncture and suck the leaves of the cabbage, giving them the appearance of being scorched. Strange to say, while this insect is on the increase, and the damage it inflicts considerable, no birds, or insect enemies seem to prey upon it. Probably, in good time, these will both present themselves for the feast, when its conspicuous black, yellow, and reddish colorings will render it an easy prey. Hand-picking in the egg, larva, and perfect state, is the only remedy yet known.

Two of the true bugs are sometimes very destructive to the cabbages and turnips. The False Chinch-bug and the Tarnished Plant-bug.

The False Chinch-bug (*Nysius destructor*), much resembles the true Chinch-bug in general appearance, but that has a black head and thorax, and two conspicuous black spots on the front wings, while in this, the False-bug, the color is more uniform and of a paler tarnished brown. The two insects differ in their habits; while the Chinch-bug confines itself to the grains and grasses, this feeds on several garden plants and the grape. The engraving fig. 32, gives the larva at *b*, and the perfect insect at *c*. This, like related insects, feeds by sucking the juices of plants by means of its beak, causing them to wilt. Like the Chinch-bug, it passes the winter under weeds and rubbish, and clean culture with the burning of all trash at the approach or winter, will aid in keeping it in subjection.

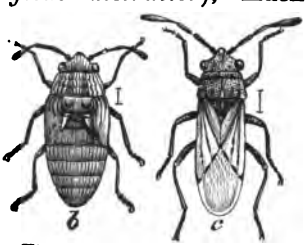


Fig. 32.—FALSE CHINCH-BUG (*Nysius destructor.*) *b*, Pupa; *c*, Mature Insect.

The Tarnished Plant-bug (*Capsus oblineatus*), fig. 33, in its general color is dirty yellow, sometimes greenish, with markings of dark brown or black. It is a more

general feeder than the preceding, and besides plants in the vegetable and flower garden, it attacks various fruit trees, especially when these are young. The principal remedies thus far recommended are tobacco water and cresylic soap. The insect is very fond of the cabbage, especially when it is in bloom, and it has been suggested to allow a patch of cabbages to run up to flower in order to attract the insects which can be more readily destroyed, when thus assembled, than when scattered over a wide area.

Fig. 33.—TARNISHED PLANT-BUG (*Capsus oblineatus*).

The Lady-birds or Lady-bugs, in their perfect state are well-known insects, and the brief description of the leading species here given will allow them to be recognized. The larval form, in which they are so useful is not so well known. The engraving fig. 34, gives their general appearance. The color is often blue, or lead color, with orange and black markings. They are remarkably active and run about with great rapidity, as they feed not only upon plant lice but upon other insects. The one represented in fig. 34, is the larva of *Hippodamia convergens*, and has done good service in keeping the Colorado Potato-bug in check, by feeding upon its soft larvæ.

Fig. 34. LARVA OF LADY-BIRD (*Hippodamia convergens.*)

CHAPTER XVI.

THE CAULIFLOWER (*Brassica oleracea* var. *Botrytis*).

Choufleur, French; *Blumenkohl*, German; *Blœnkool*, Dutch; *Cavoli fiori*, Italian; and *Berza florida*, Spanish.

The Cauliflower is the most curious, most delicate, and most valuable member of the genus Brassica. The part used, called the "curd," consists of the undeveloped flower buds, with their stems, etc., forming, when not too much expanded, a firm, white, compact head.

PROFITS PER ACRE.

Of the various crops grown by the truck-farmer, this, when all the peculiar conditions for its successful culture are present, can be made the most profitable. Peter Henderson, in his valuable "Gardening for Profit," assures us that his average proceeds from an acre, through several years, had been fifteen hundred dollars, and, that in one very favorable season, it reached nearly three thousand dollars (ten thousand to twelve thousand plants to the acre). Two years ago, the New York "Sun" reported as exceptionally high, the net sales of two barrels of cauliflower, in prime condition, from Cutchogue, L. I., at nineteen dollars each. Some of my own crop of last year, April 4th, 1882, brought, in the New York market, per bushel crate, containing an average of twenty-two heads of prime quality, but not very large, eight dollars and fifty cents gross, or seven dollars and sixty cents net. That portion of the crop shipped in crates to New York, averaged, for the first quality and "culls," five dollars and sixty-five cents gross. The first, shipped

in barrels, March 25th, containing forty-two No. 1, and forty-seven No. 2, netted twenty-four dollars and seventy-five cents per barrel.

The average gross sales per head of No. 1, in New York, were at thirty-seven and nine-tenths cents. The average gross sales per head of No. 1, in Boston, were at thirty-seven and five-tenths cents. The sales by another firm were not quite so satisfactory.

What number of plants to the acre, under favorable conditions, he may be able to nurse up to the production of marketable heads, will, of course, depend upon the gardener himself.

The Cauliflower is considered the queen among vegetables, and the supply has never been equal to the demand, though there are hundreds of acres devoted to it on Long Island, for the New York market. As seen from the prices quoted above, this vegetable is only within the command of persons of means. Fortunately for the market gardener, there are many who think as did Dr. Johnson: "Of all the flowers of the garden give me the cauliflower."

Besides large quantities used for pickling, etc., there were marketed from Long Island, in 1879, one hundred thousand pounds of cauliflower.

LOCATION AND SOIL.

The cauliflower can never become a vegetable of universal cultivation, for the reason, that it will not succeed if far removed from the moisture and the saline atmosphere of its native locality, the sea coast, unless, indeed, the required moisture can be supplied by irrigation. Erfurt, in the interior of Germany, produces perhaps the finest cauliflowers of the European Continent. They are grown between open ditches, or small canals, on "lands" so narrow as to admit of water being thrown by hand from each marginal ditch to the middle of each

"land." In watering, a scoop attached to a somewhat elastic handle, is used, thus drenching the whole crop.

The culture is often impracticable at only a short distance from a favorable location. While the northern shore of Long Island is, par excellence, the cauliflower garden of the United States; the southern shore is comparatively unfit for its growth. On the Peninsula of Florida, there must be many situations along either its west or east coast, where the soil being suitable, this vegetable may be grown with great success, and it is strange that the farmers of that State have not yet made it one of the favorite vegetables for shipment. It ought to do well near Norfolk, but the farmers there consider it a troublesome crop.

Owing to the heat and dryness prevailing during the season of ripening, the seed of cauliflower is rarely grown in this country, but is imported from Europe. One American variety, the "Snow Ball," has lately been highly recommended. I do not yet know it sufficiently to either condemn or praise it; but what little I have seen, leads me to consider it a small leaved "Dwarf Erfurt," from American grown seed.

It is necessary, even in a greater degree than with the common cabbage, to secure seed of good strain. Though all the other elements of success may be present, with seed of poor quality, failure is certain. Instead of the beautiful, snow white "curd," more like a flower in its delicate beauty than an edible vegetable, the green leaves push their way through the loose, deformed head, or the plant grows up into a stalk without heading, being perfectly unmarketable, and only fit for cattle feed.

VARIETIES.

As in the case of cabbage, a crop of cauliflower may be grown for winter, and one for heading in spring, and, as with cabbage, success with the winter crop is most uncer-

tain. Different varieties are adapted to each season. While resistance to the effects of cold is the chief requisite of the first, ability to withstand the heat is a necessity for the spring crop. The "Algiers," the variety grown so extensively in the French African colony for the winter supply of Europe (whence its name), is a good sort for the winter crop. It makes an enormous plant, and forms a large, massive, fine white head. The seed is sown, like that of cabbages, from May to September; but, owing to the greater susceptibility of cauliflower to heat, it is even

Fig. 35.—LENORMAND CAULIFLOWER.

more difficult to grow the plants. Another drawback in this latitude is the liability to have the crop killed out by freezing about the time it commences to mature. An amount of cold several degrees above that injurious to cabbage will kill cauliflower plants outright.

The distance apart for the Algiers and other bulky varieties is two by four feet. This variety is recommended to Florida growers for a winter crop, to be marketed in February, the seeds being sown early in September. For the

main, or shipping, spring crop, the early dwarf varieties, which may be expected to mature before May, that is, before the weather becomes dry and hot, are the kinds to be selected. The "Very Early Dwarf Erfurt," the "Short-stemmed Lenormand," and "Early Paris," in the order named, are the choice varieties.

The plants should, like cabbage and other plants, be put out dripping wet, about, or soon after, the first of January, so as to escape the severest cold, which, in the latitude of Savannah, may generally be looked for in the latter part of December. The seed should therefore be sown under glass in cold frames, from November 15th to December 1st. In Florida, of course, it may be sown earlier, and the plants be put out sooner, as there is little danger to be anticipated from winter killing.

CULTIVATION.

The varieties are of such dwarfish habit (particularly is this so with the Erfurt), that it is not advisable to sow earlier in the open air, and to prick out under glass. When of a sufficient age to "curd," if growth is retarded, they may in the seed-bed form heads no larger than marbles. It is, therefore, important with this vegetable, that the plants suffer no hindrance or stunting in growth, but be pushed forward from the start, without, however, allowing them to become spindling or too delicate. From eighteen to twenty-one inches in the rows, and these three and a half feet apart (seven thousand one hundred and eleven to eight thousand two hundred and ninety-seven plants to the acre) is sufficient distance for the early varieties. The manure, the depth and kind of preparation of the soil, and the cultivation of the cauliflower, are identical with that of cabbage, with the only difference, that the former perhaps requires a little more care, and will certainly reward extra attention.

PROTECTING.

Bright sunshine tans or tarnishes the snowy whiteness of the "curd," deteriorating its quality. As soon, therefore, as the head commences to be visible, it should be protected from the light, either by tying up all the large leaves over the head, or by pinning two of them together by a little stick. Protection is given more expeditiously and the light excluded by using one of the larger leaves, torn from the plant to cover the "curd" closely, tucking it between the head and surrounding leaves. If there are any caterpillars of the cabbage-butterfly on the plant, they are likely to be found on the lower surfaces of the covering. When the cutting of the crop has been commenced, leaves for covering are to be taken from plants already cut. If the protecting leaf has been carefully adjusted, the operation need rarely be done more than once, as the heads mature three or four days after they become plainly visible. The several lobes forming the head should not be allowed to separate, or the head to become loose and expanded, before cutting for market; solidity being one of the requisites of good quality.

CUTTING AND PACKING.

When the "curd" is mature, the leaves will be seen to spread out. The proper instrument for cutting is a strong sharp knife, or small hatchet. A couple only of the larger leaves are left, which are folded over the head for protection against bruising in the packages. Heads less than four inches in diameter, those tanned by the sun, or of an "off color" from any other cause, or blemished by crickets, cut-worms, or cabbage-worms, or too much expanded, should be classed as culls, and packed separately. If white and compact, a small size is less objectionable than bad appearance. Each "curd," at least of the first quality, should be covered by a piece of

smooth, soft, but tough white paper, which will admit of being tucked between the head and the leaves without tearing. The heads should be packed evenly and snugly in layers in barrels or crates, as the case may be. Each layer may be separated from the other by a piece of brown paper; if a barrel is used, the package should be thoroughly ventilated. During cool weather, cauliflower may be safely shipped in barrels or barrel crates; but as soon as the weather becomes warm, the usual bushel crate is better, as affording a smaller mass of material to engender heat. In New York and Philadelphia, cauliflower is sold by the package, and in Boston by the dozen.

INSECTS.

Insects infest the cauliflower and cabbage alike, and the remedies are the same in each case.

CHAPTER XVII.

THE CUCUMBER (*Cucumis sativus.*)

Coucombre, French; *Gurke*, German; *Komkommer*, Dutch; *Citrinolo*, Italian; *Pepino* or *Cohombro*, Spanish.

The Cucumber is one of the earliest known vegetables. Moses mentions it as abundant in Egypt. "We remember the fish, which we did eat in Egypt freely; the cucumbers, and the melons, and the leeks, and the onions, and the garlic."—Numbers xi:5.

A native of the East Indies, it was introduced into England in 1573. By means of thin plates of talc or mica (*specularia*—plates of *lapis specularis*), Pliny tells

us, the Roman emperor Tiberius, who was fond of cucumbers, had them throughout the year. The forcing consisted in growing the cucumbers in boxes or baskets of earth, protected in cold weather by these plates. The cucumber is a vegetable that is very easily grown, and is so productive when properly manured and cultivated; it is so universally popular at the North, and is consumed so largely, that when the season permits the marketing of the greater part of the produce, it is one of the best paying crops. One of the drawbacks of truck-farming is, that whether the entire product of a crop is harvested or not, as soon as the same vegetable matures at a point farther North, it comes into market in a condition fresher and more acceptable to the trade, and, therefore, excludes from profitable sale all shipments of the article from the more southern and distant points. Thus, when the Savannah cucumbers are in, those from Florida will be thrust out of the market; and the same fate awaits those from Georgia, as soon as the Norfolk crop matures. The season of 1882 was a fortunate one for the Savannah growers, nearly the entire yield of cucumbers having been marketed. While from two hundred to three hundred crates may be considered a fair crop; one farmer gathered one thousand three hundred and fifty crates from about an acre and a half, or nine hundred crates per acre, on very richly manured ground.

VARIETIES.

The only variety grown for shipment is the "Improved White Spine." In cucumber cultivation, seeds of home growth may be used. Seeds of more than one year old will be more productive, and run less to vine, than fresh seeds. They may be sown in the vicinity of Savannah according to season, about March 1st to the 15th, and earlier or later, respectively, south or north of that lati-

tude. In the middle of Florida, it may be safe to plant any time in January,

SOIL SOWING AND CULTIVATION.

The land best adapted to the cucumber is a moist, warm, light, sandy loam; although sandy soil is not so productive, the finest and earliest cucumbers may be grown on it if highly and properly fertilized.* A manure rich in nitrogen will produce fruit of the desirable dark-green color. The usual method of planting cucumbers is in hills, either four or five, or even six feet apart each way, according to the nature and fertility of the soil. The land being properly plowed and harrowed, furrows are run by the plow, crossing each other at right angles. At each crossing one or two shovelfuls of good stable manure, or compost, or failing these, an equivalent quantity of any other good fertilizer is intimately mixed with the soil, and a hill, flat on top, and a little elevated above the general surface, is made with the hoe. In a furrow one-half to one inch deep, made by the hand across the middle of the hill, sow from ten to fifteen seeds. A week later, whether any of the seeds first planted are up or not, a second sowing is made, at a sufficient distance from the first to avoid disturbing it, and always on the same side of it. A week later still, a third sowing may be made on the other side of the first. Should a frost kill the growing plants of the first seeding, before those of the second are up, plants from the second may be made available. When the plants are large enough and danger of frost has passed, thin the plants to two or

Fig. 36. WHITE-SPINE CUCUMBER.

* None of the Cucurbitaceæ, which comprises Cucumbers, Squashes, Melons, etc., should be planted on land having just borne a crop of Cabbages, for fear of the soil being infested with the larvæ of the 12-spotted Squash-beetle.

three in the hill. If the seed comes up well, and the plants are crowding each other, another partial thinning may be necessary. I prefer to manure, as for cabbage, in the furrow, and to drill in the seed on beds six feet apart, and to thin so as to leave the plants finally about twelve inches apart in the row; leaving single plants, three sowings being made as before. At the first thinning, the soil should be drawn by the hoe to the stems up to the seed leaves. The earth is to be kept loose and clean between the rows by plow and cultivator, and between the plants by the hoe, until the vines have taken possession of the ground. If the plant is stopped when it has two rough leaves beyond the second, that is, if the end of the vine is pinched off, lateral fruiting branches will be emitted, which will be early in bearing and more productive than the main vine. This operation of stopping is rarely practised in extensive planting.

GATHERING AND PACKING.

If the fruits are cut instead of being pulled off, there will be no injury to the vine; nor will the cucumber wilt so rapidly. A transverse section of the fruit should be nearly round, before the cucumber is picked; but quite green and perfect in shape. None of imperfect form, short, round and contracted at the flower end, or with the slightest tendency to turn yellow, or large and overgrown, should be shipped, as they will affect the market value of the whole package. The cucumbers should be carefully laid in the crates, or be well shaken down, as directed in the chapter on "Packing," and the crate be over-full when nailed up

SEED SAVING.

The White-spined cucumber becomes white instead of yellow, when ripe. The whitest, largest and longest should be selected for seed. Cut them lengthwise into

halves, and take out the seeds and inner pulp by hand, dropping them into a barrel or pail. The mass should be stirred daily and allowed to remain four or five days, to enable fermentation to remove the gelatinous matter which surrounds the seeds. These are then washed out in several waters, thoroughly dried, and stored away in bags.

INSECTS.

The insects which infest the cucumber are:

First.—The Cucumber Flea-beetle (*Haltica cucumeris*).

Second.—The Striped Cucumber-beetle (*Diabrotica vittata*).

Third.—The Twelve-spotted Squash-beetle or Striped-bug (*Diabrotica* 12-*punctata*).

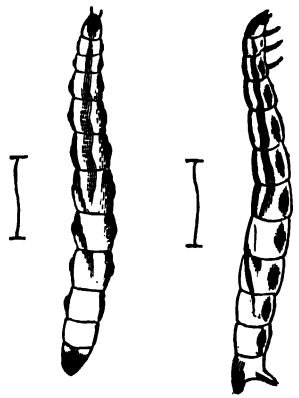
Fourth.—The Pickle-worm (*Phacellura nitidalis*).

Fifth.—The Grass-worm (*Laphrygma frugiperda*).

The little flea-beetle, like its kindred on the cabbage

Fig. 37. CUCUMBER FLEA-BEETLE (*Haltica cucumeris.*)

Fig. 38.—STRIPED CUCUMBER-BEETLE (*Diabrotica vittata.*)



Back. Side.

Fig. 39.—LARVA OF STRIPED CUCUMBER-BEETLE.

and other plants, may be driven off by freshly-slaked lime or soot.

The Striped-bug appears early in the spring as a com-

plete insect, destroying the young leaves. If numerous, these insects may be poisoned by Paris green, one part to ten of flour, before they can deposit their eggs for a new brood, of which there are three at the South. After hatching from the egg, the duration of its larval existence is about four weeks, during which time its injury to the roots of plants, by boring into them, may be considerable. The past season, an insect was reported to have been very destructive to cucumber vines near Savannah, by injuring the roots. From the description it must have been the larva of the *Diabrotica*, or it may

Fig. 40. TWELVE-SPOTTED SQUASH-BEETLE (*Diabrotica 12-punctata.*)

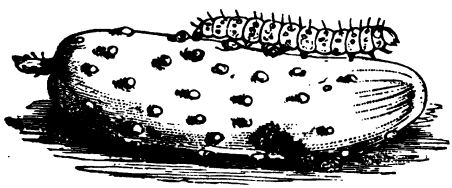


Fig. 41.—PICKLE-WORM (*Phacellura nitidalis*).

have been the true wire-worm—the larva of small snapping beetles; but most probably the former. It has been said in a recent work, "Of all the multifarious remedies proposed against the attacks of this insect, there is none so effectual, or so cheap in the end, as inclosing the young vines in boxes, which are open at the bottom, and covered with millinet on the top. Such boxes are made at a trivial cost, and if properly stored away each season after use, will last for many years."

Fig. 42.—MOTH OF PICKLE-WORM.

The private gentleman, having half a dozen cucumber vines in his garden, may avail himself of such a

remedy, but the farmer, who fails to protect his crop by destroying the first insects by poison, in case of their visitation in devastating numbers, and to whom the alternative is offered, would probably give up the cucumber to Diabrotica, and betake himself to another crop, rather than use from forty thousand to eighty thousand boxes for the protection of from six to twelve acres.

The third of the beetles infesting the cucumber, the

Fig. 43.—GRASS-WORM (*Laphrygma frugiperda.*)

Fig. 44.—LARVA OF GRASS-WORM.

twelve-spotted Diabrotica is not so destructive as the former species.

The cucumber is the regular food plant of the Pickle-worm (*Phacellura nitidalis*) while the more omnivorous Grass-worm (*Laphrygma frugiperda*) only occasionally feeds upon it. Both these lepidopterous insects become numerous too late in the season to affect the crop of the truck-farmer seriously.

CHAPTER XVIII.

THE EGG-PLANT, OR "GUINEA SQUASH."
(*Solanum melongena.*)

Aubergine, French; *Eierpflanze*, German; and *Melanzana*, Italian.

The Egg-plant is of tropical origin, and was introduced into England from Africa in 1597. It derives its common name from a small white variety which is similar in shape and appearance to the egg of a goose.

Only a very few years since, the demand for egg-plants (as the fruit is called), was so limited in the New York market, that but a few could be sold, and it did not pay to plant a crop for shipment. This was probably in part owing to the fact, that the cultivation of this plant at the North is attended with trouble, in consequence of its tenderness, and a successful crop is doubtful. Latterly a more general taste for the vegetable seems to have been developed, and its consumption has greatly increased. As late as July 8th, last (and egg-plant had been in the Savannah market from Florida since January), a shipment of my own, averaging about sixty-five fruits to the barrel, sold in the New York market at six dollars per barrel. The farmers of the southern part of Florida, from Tampa to Key West, being exempt from frost, may produce such tropical vegetables at will, as far as season is concerned. On Dec. 1st of last year, egg-plants and tomatoes were mature at Clear Water. The only variety cultivated for market is the "New York Purple Improved." This being a tropical fruit, or berry, it must reach its greatest development and mature its seed most perfectly at the South, for which reason it is not only possible, but advisable to use seed of home growth in preference to that produced at the North.

Fig. 45.—EGG-PLANT—"NEW YORK PURPLE IMPROVED."

The seed and young plants require more of a tropical heat (65° to 70°) for their germination and continued

healthy growth, than any other crop, and should, therefore, be sown by themselves under glass in cold frames. After sowing, the bed should be well watered and the glass placed on, and not removed until the seed is up. In case of hot sunshine before germination, the sash should be partially shaded. If it is contemplated to prick out the plants into other frames, the sowing may be as early as the middle of January; otherwise ten or fifteen days later. The management while under glass is about the same as with other tender plants, with the exception that they require more careful exclusion of cold air, and have more frequent protection from slight variations of temperature by the glass, than the tomato, pepper, etc., and they will bear a greater degree of heat without being drawn. No vegetable with which I am acquainted, can withstand drouth better than the egg-plant, which bears and matures its fruit under a degree of heat and dryness that would be fatal to other crops. If there be a sufficiency of decayed vegetable matter in the soil, this crop may be allotted to the sandiest part of the farm. If planted in low, although thoroughly drained, land, the plants are apt to die off about the time they commence to bloom or bear, a peculiarity more or less common to all the Solanum family. To mature early fruit of the size and quality required by the trade, a shovelful or two of fermented stable manure, or compost, should be mixed in each hill. The hills should be two and a half by four feet apart. The cultivation is about the same as that of any other hill crop. The earth should be slightly drawn to the stems during the hoeing, not sufficiently, however, to touch any of the lower branches. The plow and horse-hoe, once each, run between the rows, and two hoeings should be sufficient for the crop in light unbaked land.

To cut through the tough stems, without disturbing the plants, a thin-bladed, sharp knife, or a pair of nippers

is necessary. To be marketable at good prices, the fruit should be well grown, weighing from one to three pounds but not old, nor light colored and tough; small ones are not readily salable. They are to be carefully handled to avoid bruising and injuring the gloss. Shorten the stems to about half an inch and wrap each in paper. It is then to be firmly and evenly packed in crates, or in well ventilated double-headed barrels. The Flea-beetle frequently attacks the plants when young, for which the usual remedy of lime or soot is applicable, but rarely necessary.

The large green Tomato-worm is sometimes found on the egg-plant. Should these, the Tortoise-beetle (*Cassida Texana*) or the false Colorado-beetle (*Doryphora juncta*), already mentioned, ever become destructive, Paris green might be applied before the fruit, or berry, is formed.

CHAPTER XIX.

KALE, BORECOLE, OR SPROUTS (*Brassica oleracea*—var. *sabellica.*)

Chouvert, French; *Krauskohl* or *Braunkohl*, German; *Bœrenkool*, Dutch; *Cavolo aperto*, Italian; *Col*, Spanish.

Kale is a variety of the cabbage of great excellence for the table. It is distinguished from the other varieties by its open growth and its more or less curled or wrinkled leaves. It is the most hardy of all, and withstands a severe degree of cold; indeed, it is not considered to have reached the perfection of flavor and tenderness, until it has been frozen.

Among the many varieties of kale some are dwarfish in habit, while others grow from four to five feet high.

Kale is rarely grown at the extreme South for the Northern markets, its extensive cultivation being confined to Norfolk, Va. The price in the New York market rarely exceeds two dollars and twenty-five cents per barrel. The varieties cultivated are: a local one, called the "Blue Curled," and the "Green Curled Scotch;" the former by far the most extensively.

The preparation and character of the soil, quantity and kind of manure, and the cultivation of the crop must be similar to that of the other varieties of cabbage. The "Blue Curled" is sown from August 10th to September 15th, at Norfolk, in drills thirty inches apart, at the rate of a pound and a half of seed to the acre; the plants are eventually thinned to a stand of from four to eight inches in the row. The "Scotch Curled," to a much smaller extent, is sown in seed-beds early in August, and transplanted in September from eight to ten inches apart in the row.

Fig. 46.—KALE.

The crop is cut for shipment in March. The size of the plants, when cut, varies from six inches to two feet across, and, therefore, the number which will fill a barrel varies greatly. It must be very firmly packed in well-ventilated barrels, as with the best care, it will shrink in consequence of its loose growth. It is subject to the same insects as the cabbage, and, sown as it is in the open field in the fall, is affected by the young cut-worms. See chapter on "Insects."

CHAPTER XX.

LETTUCE (*Lactuca sativa*).

Laitue, French; *Garten-salat*, German; *Latuw*, Dutch; *Lattuga*, Italian; *Lechuga*, Spanish.

The Lettuce is a hardy annual which was first cultivated in England in 1562, but whence it was introduced is not known.

Owing to its freedom from insect depredations (exclusive of the cut-worm), its large consumption, and the ease with which it can be grown, lettuce is one of the most important crops of the Northern farm-gardener, notwithstanding the fact, that, of late years, it has become subject to a disease. In New York, the winter and very early spring markets are supplied from hot-beds, in which it is grown in and near Boston, where a specialty is made of this vegetable. In consequence of this extensive supply of superior and fresh stock, the more wilted condition of shipments from the South renders the cultivation of it here unprofitable. It is grown, however, to a considerable extent at Norfolk.

A good sort should form a solid and large head. The varieties used at Norfolk are: "White Cabbage" and the "Boston Market," or "Tennis Ball," the former for open field culture, and the latter under glass.

The seed is sown under glass in September, the plants put five or six inches apart, and the crop is ready for market in February and March.

The trouble with this crop is the liability of the plants to damp off under glass.

For the open field, the seed is sown about the middle of September in a bed, and not quite as deep as cabbage seeds, the plants are transferred to flat beds, setting them

about nine inches apart each way, to be cultivated entirely by the hoe, or in rows eighteen inches apart, the plants standing eight inches in the row, which will admit the use of a narrow cultivator between the rows.

This crop is marketable in April.

Any well-drained soil, made fine and mellow, and well manured will produce good lettuce.

After cleaning, or trimming the heads of soiled, or discolored leaves, they are firmly packed for shipment in crates, barrels being unfit for this crop.

MUSKMELON, or CANTALOUPE. See additional chapters, pages 251, 252.

OKRA, or GUMBO. See additional chapters, page 253.

CHAPTER XXI.

THE ONION (*Allium Cepa*).

Ognon, French; *Zwiebel*, German; *Uijen*, Dutch; *Cipolla*, Italian; *Cebolla*, Spanish; *Alho*, Portuguese.

The alliaceous esculents are of great antiquity and of universal cultivation in every civilized country, some nationalities preferring one variety, and others a different one. The same genus includes the Leek (*Allium Porrum*), the Chives (*A. Schœnoprasum*), the Garlic (*A. sativum*), the Shallot (*A. Ascalonicum*), and the Rocambole (*A. Scorodoprasum*). The onion (*Allium Cepa*) is the only species with which the truck-farmer has any concern. There are many varieties of the onion, only a few of which are grown for the Northern markets.

ANALYSIS.

According to Prof. C. A. Goessman, a crop of four hundred and forty-two bushels contained:

Potassium oxide	38.51 lbs.
Sodium oxide	1.90 "
Magnesium oxide	3.60 "
Calcium oxide	8.20 "
Sesqui-oxide of iron	0.58 "
Silicic acid	3.33 "
Phosphoric acid	15.80 "
Sulphuric acid	29.81 "
Nitrogen	48.63 "

The peculiar characteristic odor is due to a volatile organic compound containing sulphur.

Onions are used medicinally as stimulants, diuretics, and anthelmintics (worm medicines). Boiled or roasted, they form emollient poultices. The fresh root irritates or reddens the skin, and the expressed juice is sometimes used in ear-ache and in rheumatism.

It has generally been held, but erroneously, that the onion could not be successfully grown from the seed, at the South, and that, below about the fortieth degree, the dry heat of our summers would dwarf the bulbs. Egypt and the Barbary States produce, perhaps, the finest onions in the world, several of the largest varieties having originated in Tripoli. Large quantities are annually exported from Portugal and Spain. The opinion prevails in Germany that the seed, at least of some varieties, will deteriorate, unless of southern growth; and those of the Madeira onion, used in Bermuda for the crop so popular in our Northern markets, are grown in the south of France. I have grown most varieties of the onion successfully for the past twenty-two years, having produced, one season, the "Giant Rocca" at the rate of ten hundred and fifty bushels per acre. The usual yield is from three hundred to eight hundred bushels. At no time of the year are the Northern markets entirely bare of this indispensable vegetable, some variety in its green or matured state being procurable.

The aim of the Southern grower should be to slip his crop into the market at a time when the supply from other sections is most deficient. The first matured bulbs

in the spring found in the Northern markets are the Bermuda grown "Madeira" onions. Although it might be possible to grow as fine onions in Florida from autumn-sown seed, the attempt to compete with Bermuda onions for favor would seem fruitless at present. South Florida might even anticipate the Bermuda crop. The next onions, other than from this section and from Florida, offered in market, are the "Potato onions," grown near Norfolk and in Maryland. Southern onions will be apt to bring the most satisfactory prices about the time the supply from Bermuda is becoming exhausted, which occurs about June 15th. While no variety of Southern-grown onions will keep during the winter, should they ripen a little prematurely, they may be preserved sufficiently long to allow the shipments to be so timed as to meet this demand.

Fig. 47.—ONION—"GIANT ROCCA."

VARIETIES AND SEED.

Of more than one hundred varieties, the common "Red Wethersfield" and "Yellow Danvers" are the best keepers. The beautiful white "Italian Queen" is the earliest and surest, but is too small. The "Giant Rocca" makes an enormous yield, but is too large for market. The now popular "Globe Madeira" will be the best to succeed the Bermuda crop of the same variety.

Of no other vegetable, save the cauliflower, is it so im-

portant to have a good strain of seed. If saved from bulbs of objectionable form, or imperfect development, scallions, instead of the desirable globular onions, will be the result.

No seed older than of the previous crop should be used, as it rarely retains vitality over one year; it is also well to put it to the preliminary test recommended in the chapter on "Seeds," in order to gauge the drill in accordance with the percentage of sound seed. It will germinate in three or four days, if kept warm and moist. The seed is frequently soaked from one to four days, but I cannot recommend the practice. If it is found to be of fair quality, to be perfectly reliable, the drill may be gauged to drop a seed every quarter to half an inch, at which rate it will require from three to four pounds to the acre. If sown too thickly, great labor is required to thin the plants, as it must be done early enough in their growth to prevent injury by crowding, and to avoid breaking the roots of those to be left.

SOIL AND SOWING.

Onions may be sown at any time in the fall, the weather being favorable, but there is nothing to be gained by such very early planting. In the latitude of Savannah, and northward, the young plants of October or November sowing may be exposed to injury from heavy rains, or, notwithstanding the very hardy nature of the onion, from severe freezing in December. The crop from seed sown about January 1st escapes these dangers, comes in early enough for the better demand, and, growing through a shorter and warmer period, will require less extended care.

The onion is intolerant of the vicinity of trees, and requires an open exposure.

The soil best adapted to this crop is a deep, rich, friable warm mould, full of vegetable matter, such as is fre-

quently found in river bottoms and drained ponds. On heavy land, the bulbs are apt to remain small, and acquire a greater pungency of taste. If the soil is loamy, sand should be the predominating constituent. Land recently cleared, and therefore free from grass and weed-seed, provided it is made perfectly mellow, is always to be preferred to old land, particularly unless the latter has been kept clean of weeds and grass, in order that none of their seeds may have been self-sown for several successive years. Although the onion is a very shallow-rooted plant, it delights in a well-drained, deeply-stirred, and finely-pulverized soil. No plant requires a more careful preparation of the land, and a proper piece, once selected for this crop (it being an anomaly in regard to rotation), it should always remain appropriated to the same purpose; for, with proper and efficient manure and management, the crop may be increased in quantity each successive year. The land should be allowed to mature no second crop. As soon as the onions are removed, it should be sown down to cow peas. If recently cleared land is selected, it should also be sown with peas in July or August. They will not only keep down the weeds, and tend to mellow the soil by the decaying mass of vegetable matter, but maintain and increase the fertility of the soil.

The first of December is early enough to plow under the dead pea vines, which should be deeply buried.

The analysis shows that the onion requires a rich nitrogenous manure, and that it also contains much potash and phosphoric acid. The manure of the hog is generally considered the best for this crop. If stable manure is used, it should not be coarse enough to prevent its being plowed under shallow. There is no objection to fine, green stable manure, provided it contains no seeds of weeds. If the animals have been fed on hay, the manure must be thoroughly fermented to destroy the vitality of

the grass seed. The onion is a gross feeder, and, without adequate manuring, there will be no satisfactory crop. The plants will not form bulbs properly if poorly fed. The yield will be in proportion to the quantity and quality of the manure. Thirty loads, of thirty bushels each, sufficiently compressed, or fermented, to weigh forty pounds to the bushel, is not a heavy application. Twenty-five loads of night-soil would do as well. If other fertilizers, such as bone-meal (which is excellent), or guano, are used, they should be harrowed in so as to permit the roots of the young plants to reach them. A top-dressing of a hundred bushels of ashes per acre is beneficial.

After several years of manuring with stable manure, a change to a half ton of bone-flour, ammoniated superphosphate, guano, or five hundred pounds of sulphate of ammonia would be advisable. If the land is new, or loamy, a cross plowing and double harrowing may be necessary to put it in proper trim to receive the manure. It should be level, lest heavy rains may wash out the seed on the higher points, and cover the plants in lower ones too deeply. At the South, where we are visited by heavy rains, onions, on a small scale, are best planted on four-feet-wide "lazy beds," the intervening paths acting as auxiliary drains. The seed may be sown upon these beds by hand, in drills half an inch deep, twelve inches apart, across the bed. On a larger scale, where machines must be used, making two drills at a time, the sowing had better be done on narrow lands, fifteen or twenty feet wide, the rows running lengthwise, twelve or fifteen inches apart. Beds, or narrow lands, are formed in plowing under the manure, previously applied broadcast, as shallow as possible, and, if the furrows intervening between the lands are too shallow to act as drains, the loose soil is to be thrown out upon the beds with hoes or shovels. The surface must be thoroughly fined with harrow and hand-rake. In fair weather, the seed will be up in two weeks.

CULTIVATION.

The only sure road to success in onion culture, even when all other conditions are favorable, is clean cultivation, and as soon as the lines of young plants are distinguishable, hoeing should be commenced, and repeated, with hand-weeding, whenever necessary, no weed being allowed to grow large enough to disturb the roots of the onion, when pulling it, and be continued to within about a month from the time the crop matures. The soil should be stirred between the plants in the row.

The chief objection to this crop is the amount of careful labor required to keep it clean, at least four or five hoeings being necessary, for which the scuffle, push, or Dutch hoe is the best implement.

Onions grow best upon the surface, as their roots do not penetrate the soil deeply; therefore, the hoeing must be superficial, and no soil should be drawn to the rows. They should be thinned to four inches in the row, if only large bulbs are wanted, but in case a large yield is desired, irrespective of size, the stand may be closer. Transplanted onions take root very readily; therefore, any vacant spaces may be supplied, or new beds made with the plants removed in thinning, cutting back the roots to about an inch, and the leaves one-half their length. The roots should be put down straight, and the plants deeper than they grew originally. If onions have room laterally, groups of four or five may be left together, because in their efforts for survival, they will push one another sidewise, and mount on top of each other, and still form round, marketable bulbs.

HARVESTING AND MARKETING.

At the North, where the onions are to be stored for winter use, the whole crop is pulled when three-fourths of the plants have turned yellow, shrivelled and dried in

the neck sufficiently to topple over. At this time, some of the roots are dead, and have lost their hold upon the soil. The onions are allowed to remain spread upon the ground for two or three weeks to dry, before being housed. They are in fit condition for storing, when no moisture is visible upon strongly twisting the necks. Here, the crop being wanted for an early market and immediate use, the onions are pulled, as they successively indicate maturity by toppling over, and are left on the ground a day or two, or they are removed at once, and the necks cut off with a sharp knife, an inch or so from the bulb, when they are carefully packed in bushel crates and shipped.

A vegetable, not a luxury, and rarely, if ever, out of market, cannot be expected to bring high prices. Onions range between one dollar and two dollars and fifty cents per bushel crate. In our local market they brought last June from two dollars and twenty-five cents to two dollars and seventy-five cents per bushel crate.

A globular-shaped onion will produce a crop one-third larger than one that is flat in form.

RAISING ONION SEED.

If properly matured, and carefully preserved, Southern-grown seed is as good as any. The onion being a biennial plant, it produces seed the second season. The bulbs from which it is contemplated to save the seed should be selected, choosing those which combine the distinguishing peculiarities of the variety, in order that the seed may remain true. If planted in the fall, the seed will be ripe the following July or August. The soil should not be as rich as for the crop of bulbs, lest the flowers may blight and form no seed. The rows should be about eighteen inches apart, and the entire bulbs pressed into the soil below the surface, about eight inches apart in the row. The seed stalks of some of the varieties are five feet high, and unless they are supported,

they will break or bend over, until the seed heads either touch the ground, or approach it so closely as to be damaged by the moisture. This support is most easily given by stretching twine a few inches below the seed heads, one along the middle of the bed, and another on the outer edge of every bed. The seed is ripe enough for gathering, when the pods commence to burst open, and heads and stalks turn yellow. The stalks are carefully cut six or eight inches from the heads, which are allowed to fall into a bucket or open bag, otherwise some of the seed may shell out and be lost. Partly-matured seed will not ripen fully, if the stalk is cut close to the seed-cluster.

These must be spread out upon the close floor of a dry loft, or hung up to dry thoroughly, when they may be thrashed out, winnowed, and washed. The false seed and husks will float upon the surface of the water, while only the good seed will sink to the bottom of the vessel. The seed must be quickly and thoroughly dried in the sun before being stored away.

ONION SETS.

At Norfolk, onions for the Northern markets are not grown from the seed, as the crop would not sufficiently anticipate those of more northern latitudes; but from sets* or small onions. Those of the "Potato-onion" are put out in August and September, and sets of the "Silver-skin" and "Yellow Danvers" in February.

The "Potato-onion" produces no seed, but forms from three to ten small bulbs around the old one, from which it is propagated. These small bulbs, when planted out, increase in size, and form a large and marketable onion. These produce the earliest crop of local growth, and even survive the winter as far north as Vermont. The prep-

* The English word "sets" may have come over from the German "Setz-Zwiebel," that is: planting-onions.

aration of the ground for these and for other onion sets is the same as for the crop from seed.

The sets are pressed into the soil at the distances the crop is to mature, the tops about level with the surface, care being taken to have the root end down. The sets should range in size from that of a pea to a common-sized marble. The smaller the better. When the bulbs are too much developed, they are apt to run to seed instead of producing good onions. Onion sets are often high-priced, costing from five to ten dollars per bushel; but they may be grown at the South with proper management. The land should certainly be free from weeds and grass, lighter and less richly manured than for the crop. The rows may be ten inches apart, and the seed should be sown late in the season, about May 1st, and much thicker than when intended to produce large bulbs. From fifteen to twenty pounds to the acre are required.

INSECTS.

The larvæ of the Dipterous, or Two-winged insects, which at present infest the onion in this country, penetrate it at the root; and the first indication of their presence are symptoms of disease and approaching death. There is no remedy, but to dig up every wilted and yellow plant, and to hunt for and destroy the grub within the rotting bulb, with a view to curtail future depredations.

The black Onion-fly (*Ortalis flexa*), is a native of this country, while (*Anthomyia ceparum,*) is an imported insect.

CHAPTER XXII.

THE PEA (*Pisum sativum.*)

Pois, French; *Erbse*, German; *Erwat*, Dutch; *Pisello*, Italian; *Pesoles*, Spanish; and *Ervilha*, Portuguese.

The pea is a hardy annual, a native of the south of Europe, and has been cultivated from time immemorial. We are told that, in the time of Queen Elizabeth, peas not being very common in England, they were brought from Holland, and that they were "fit dainties for ladies, they come so far, and cost so dear." Where labor for picking the crop is plentiful, it is one of the indispensable crops of the truck-farmer, bringing in the first proceeds of the season.

VARIETIES.

A good market variety should be productive, of good flavor, form full, pods plump, and be of uniform growth. Frequently a gardener plants poor seed, which runs to vine, and produces but few good pods. The varieties themselves are subject to change, and will deteriorate, unless constant care is exercised in growing them for seed. The varieties at present preferred, enumerated in the order of their earliness and value are:

First.—The "Early Alpha." This is, exclusive of the "American Wonder," the only wrinkled Dwarf Pea. It grows three feet high, is very productive, and produces large pods of dark green color. The objection to all the wrinkled peas is, that they must be sown thicker than the round varieties.

Second.—The "Philadelphia Extra Early." This is very uniform, when the seed is pure, and is productive.

Third.—The "Daniel O'Rourke." This is an excellent early pea, and is very popular with Northern growers. Its height is about three feet.

Of the later kinds, the "Black-eyed" and "White-marrowfat" take equal rank, and grow about four and a half feet high.

SOIL AND SOWING.

The large, later and more hardy marrowfat varieties may be planted in the vicinity of Savannah as early as November 20th, following with the earlier kinds; but in usual seasons December 1st is early enough for the first sowings. In the case of a plant so hardy as the pea, it is possible to grow it, in middle to south Florida, to mature at any time during the winter. It is well, if a large crop is to be planted, to make separate sowings at intervals of a few days, in order not to have the whole planting subject to unfavorable contingencies at the same stage of growth. No usual degree of cold in this latitude will hurt the pea, unless it be in bloom or pod.

A dry, rich, warm, sandy loam is the best soil for this crop. For the wrinkled varieties, it is especially necessary that the soil should be warm and dry. These do not seem to be so well matured as the round sorts, and in moist, or wet and cool soils they may fail to germinate, and may rot in the ground. Good stable manure is the best. The field being in proper condition, it is manured in the furrow at the rate of twenty-five or thirty loads, of thirty bushels each, to the acre, the rows being five or six feet apart, according to the variety. The seed is sown in double drills, about ten inches apart, on flat beds or ridges over the manure. The quantity of seed required for an acre is about two bushels. As regards the distance in the row, the peas are distributed according to size, about half an inch to an inch and a half, by hand, or by means of a drill, which sows both parallel drills at the same time.

The opinion, I believe, generally prevails that the deeper peas can be sown, the more productive will be the crop, and the longer will it remain in bearing. One and one-half inch is the usual depth in a sandy loam.

CULTIVATION.

As the growth of the pea crop extends through the winter and early spring, when weeds are not abundant, cultivation is only, or chiefly, necessary as a promoter of growth. The soil between the ridges may be stirred twice, or more frequently in an unfavorable season; but as soon as the plants grow to two or three inches, the earth should be hoed to the stems, when dry, gradually earthing higher up, as the peas increase in hight. All peas, save the dwarfs, not only fruit better, but continue longer in bearing and mature better, if they are bushed. As soon as they commence to "run" to vine, or to put out their clasping tendrils, which will be when about ten or twelve inches high, according to variety, they should be bushed or stuck. Branching sticks are thrust between the drills so firmly into the ground as not to be blown down, and near enough to be a support for all the plants. This will not only be facilitated, if the sticks cross each other in the row near the surface, but they will be a mutual support. When the bushes from which the sticks are to be cut are more or less convenient, the expense of this sticking will be from three to five dollars per acre. The first shipments are usually made from Savannah about March 10th. The early varieties admit of about five pickings; the later, one or two more; one hundred and fifty to two hundred crates being the yield per acre.

Peas were sold the past season at from one dollar and fifty cents to five dollars and fifty cents per bushel crate, while fifteen years ago I received twenty dollars per barrel on April 5th.

No pod should be picked or packed which is yet flat, for the reason that the peas are not sufficiently developed; and none that are discolored or rough from over-ripeness should be marketed. The ordinary bushel crate is the only package used at present. The contents should be thoroughly shaken down, and the crate be more than full, when ready to be nailed up.

The two weevils, *Bruchus pisi* and *Bruchus granarius*, which are principally injurious to the pea, affect the farmer only in so far as they are destructive to his seed, the larvæ inhabiting it and feeding on its substance.

Though they usually leave the germ untouched, and buggy-peas will germinate, yet the plant, being without

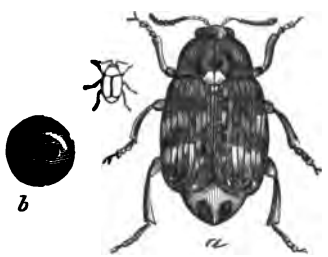


Fig. 48.—PEA-WEEVIL (*Bruchus pisi*). *a*, Beetle, enlarged; *b*, Pea, with spot.

Fig. 49.—GRAIN BRUCHUS (*Bruchus granarius*).

the nutriment provided for its early growth, is weak at the start, and is never so vigorous and productive as those from sound seed. Our common Pea-weevil (*Bruchus pisi*) is given in fig. 48, much enlarged, its real size being shown in the outline at the left. The Grain Bruchus or Barn-beetle of Europe (*Bruchus granarius*), fig. 49, infests both peas and beans. It is sometimes imported with foreign seeds, but has not yet become naturalized. It is somewhat smaller than the Pea-beetle, and the markings of the two are very different.

The Cotton Boll-worm (*Heliothis armigera*) is sometimes found feeding upon the pea, but too seldom to do much harm.

CHAPTER XXIII.

THE POTATO (*Solanum tuberosum.*)

Pomme de terre, French; *Kartoffel*, German; *Aardappel*, Dutch; *Tartufi bianchi* or *Pomo di terra*, Ital; *Papas*, Spanish.

The active principle, Solanin, characteristic of the family *Solanaceæ*, to which the potato belongs, has been found, but in much smaller proportions than in other members, in the sap, in the berries, and also in tubers of the potato after they had sprouted. For this reason sprouted potatoes are less valuable for food than before the development of sprouts, although in the process of cooking a change is effected in the composition.

The chief organic ingredient of the potato is starch, which forms about one-tenth of its weight. It has generally been admitted, that the potato was first introduced by the Spaniards into Europe from South America (it is still found in its wild state in the mountains of Chili), and that Sir Walter Raleigh introduced it into England from Virginia. Whether this is strictly the history of its appearance in Europe, or not, the potato has been found indigenous in Mexico and Arizona. Johnson wrote: "The potato is one of the greatest blessings bestowed upon mankind; for, next to rice, it affords sustenance to more human beings than any other gift of God." Unlike the latter (the continuous use of which sometimes affects the eyes), it may be the exclusive food of man for an extended period without injuring the system. And it is owing to the absence of any distinct peculiarity of taste, to its wholesomeness and to its consisting largely of starch, in every particular resembling the flour of grain, that it may be continuously used as

a chief article of food for a longer time than any other vegetable. It is somewhat strange, that the family which embraces the deadly nightshade, and other very poisonous plants, should also have among its members this most useful vegetable, besides a few others that are mentioned in this book.

Of all the crops of the truck-farmer, the potato is the one which is always salable at more or less remunerative prices; its general use among all classes and nativities of the population, precluding a glut in the market.

Owing to the prevalence of drouth at the North during the summer of 1881, the staple crops of potatoes and cabbages having been failures, the winter stock was so nearly exhausted, that extensive importations were made from Europe; and when our Southern crops came into market, they enjoyed an unprecedented demand and high prices. My own small crop sold at from six to seven dollars for No. 1, averaging six dollars and sixty cents per barrel, and "culls" from three dollars to four dollars and fifty cents, averaging three dollars and forty-five cents per barrel.

Those farmers who planted largely and had good crops of these vegetables made a "hit" in their operations. It is likely that others, induced by this success, will plant potatoes and cabbages more heavily than usual, and reduce the acreage of other valuable products. I embrace this occasion to advise truck-farmers, that they will probably thrive better in the course of time, by confining themselves to their usual areas of each crop, and by not allowing themselves to be influenced by periodical successes with any one vegetable.

VARIETIES.

A variety of potatoes to be cultivated by the Southern truck-farmer should be productive in our climate of large and even-sized tubers, growing close together in the hill,

with few or no small ones, it should be early and be popular enough in the Northern market to command the highest prices. At present the "Early Rose" meets these requirements and is generally the favorite, but the "Early Sunrise," "Beauty of Hebron," and the "Burbank," are also planted. The potato grown in Bermuda is the "Chili Red." Recently some Charleston farmers have planted this variety in preference to the "Early Rose," the latter not having given satisfaction.

SIZE OF SEED.

One of the mooted questions in gardening is: shall we plant the whole potato or cut it up into sets? Experiments have failed to establish any certain rule; and the intelligent farmer will understand that circumstances must govern the case.

The potato tuber is not a root, for it has neither root-hairs itself, nor has the stem which connects it with the parent stock either fibrous roots or root-hairs and, therefore, provides the plant with no nourishment; nor is it a seed any more than is a stick of sugar cane a seed. The tubers are nourished by elaborated sap descending from the leaves through the bark. The formation of abnormal tubers above the ground at the point where the stem of a plant has been injured by a cut-worm, or otherwise, or in the axils of branches, is, among others, a proof of this. The potato is an enlarged underground stem, and the eyes are buds. These buds are more numerous at the point furthest from the plant, just as the buds are closer together at the end of a branch of the fig or any other tree. When the potato has dried out sufficiently and is surrounded by favorable conditions of warmth and moisture, the eyes or buds begin to grow; and until roots have been emitted for their nourishment, the shoots are dependent upon the starch of the surrounding substance for their support; resembling a seed in this respect. The eyes are independent of each other,

having no vital connection. If both eye and tuber be sound, the shoots will grow to be healthy plants, if conditions are favorable, whether they be planted with the entire tuber or only connected to a small piece of its detached substance.

The following rule has been given: cut large potatoes to single eyes; small potatoes will produce as good a crop if cut in pieces corresponding in size, for the young sprout requires substance to push it forward. The intelligent farmer should have an object in view, and his operations should be undertaken to attain it. In this case his purpose is to procure a crop of as many large potatoes as possible. It will not be secured, if many stalks grow from each set, any more than four or five stalks of corn to the hill will produce large ears of corn, though single stalks may. Whatever be the size of the potato, it should be fully matured. If any Irish or Sweet potatoes are found rotten in the hill, they are always the largest, which have decayed after becoming over-ripe. It is, therefore, safest, for fear of having many stalks in the hill, to use a medium-sized tuber, cut to single eyes, provided the buds show signs of development. If none of the eyes are developed, or only one is, that one only, from the whole potato, is apt to grow, the rest remaining dormant. The eyes upon seed potatoes procured from the North are very apt to sprout upon arriving in our warm climate, and these should always be cut to single eyes. Northern seed potatoes should not be imported, until the farmer is ready to plant them. If the first shoots are rubbed off or killed by frosts, the succeeding ones will be weaker and are apt to be more numerous.

In cutting potatoes to single eyes, the cutter commences at the stem end, where the eyes are less abundant, and slices off pieces with a single eye to each, in such a manner as to distribute the substance of the tuber

as equally as possible. If rules are to be given, they should be: cut a large potato to single eyes, whether sprouted or not. Small potatoes may not be ripe enough to grow strong shoots; but if a small potato is enough matured to put forth sturdy sprouts, cut it also to single eyes; for very little substance will suffice for their support; but, if the potato has not sprouted, it may be planted whole, without much danger of its pushing up more than one stalk. Of late years, Southern truck-farmers have found that home-grown seed of the second crop of Irish potatoes, maturing late in the fall, whether cut or not, gives the best yields, and southern seed are now preferred from Norfolk to the Gulf. The tubers, being a shorter time out of the ground, are not so dry, and put forth only single shoots. There is no fear that their first sprouts have been rubbed off before planting. If frost cuts down the young plants, unlike northern seed, only single shoots will appear, yielding large potatoes, instead of many too small for market.

SOIL AND CULTIVATION.

In an open, warm, sandy soil, the sets may be planted soon after being cut; but for a cool, moist and heavier soil, the cut surfaces should be dried by spreading the sets in the shade for a day or two, or, if put up in bulk, sprinkle with lime or land-plaster.

The quantity required to plant an acre will be about three to four barrels, according to the size, and the manner of cutting the potatoes. While the plant is indigenous to Southern latitudes, it is found at considerable altitudes above the level of the sea, and partakes of the peculiarities of those of cool climates, generally succeeding better at the North than at the South. Unlike its relatives, the egg-plant and tomato, it is intolerant of dryness and heat, and should therefore be planted as early as the season will admit, in order to escape warm weather. About February 1st is soon enough for the

"Early Rose." Some varieties start even earlier than this, and a week later would better suit the "Beauty of Hebron," for instance. If Southern stock is offered in the Northern markets while the Northern winter supply is abundant, and still of good quality, very good prices can not be expected. It will, therefore, not be the policy of Florida growers to put in their crops much earlier than the date named.

On account of its native habitat the potato requires at the South a cool, moist soil. Low, black moulds in river bottoms, if well drained, may give enormous yields; but the product is apt to be of inferior quality and decay readily, the gluten predominating over the starch in its composition. No vegetable varies more in quality on different soils. A variety may be fine on a good soil and nearly worthless for table use on one not adapted to it. The mealiest and best-flavored potatoes are grown on sandy soil, but for a satisfactory yield, a good, rich, sandy loam, with an abundance of vegetable matter is indispensable.

Whatever be its character, the soil should be broken up deeply and thorougly mellowed, in order that it may absorb and retain moisture. Freshly cleared ground, of good quality, produces better crops than old land, probably in consequence of its greater content of potash. The soil should have been previously enriched for a preceding crop. The roots will extend beyond the drill, and poor land fertilized with the same amount and quality of manure in the furrow will, therefore, not produce satisfactorily.

Stable manure or barn-yard manure is chiefly to be relied upon by the potato grower. Composts of good commercial fertilizers with leaves or leaf-mould with the specially adapted potash salts, or ashes and bone-flour, may be used where a sufficiency of stable manure cannot be had. As a rule, land can scarcely be made too rich

for the potato. The new varieties, unlike old ones, will not run to vine from heavy manuring; but will yield in proportion to their food, probably in consequence of their greater, and yet undiminished vigor. Fresh, dry stable manure, especially in dry, light soil, should not come in contact with the sets, lest the heat destroy their vitality. The same applies to Peruvian guano, fish scrap, hen manure, etc. Rich animal manures may render the tubers rough, ill-shaped and knobby. If the common German kainit is used, it should be sown broadcast, or harrowed in, two months before planting time, for fear the chloride of magnesium it contains may otherwise injure the crop.

The enormous prize crops reported some years ago to a New York house, for instance of ten barrels, or fourteen hundred and seventeen pounds from a single pound of seed potatoes, nineteen pounds from a single hill of two sets, prove the astonishing effects of heavy manuring, and at the same time the possibility of the use of very small sets. In some cases a single eye was subdivided into ten pieces, a single pound furnished two hundred and forty sets. The largest crop, per acre, upon record was made about forty years ago by Mr. Knight, the celebrated horticulturist, and President of the Royal Horticultural Society (Eng.), of thirty-four tons (English) and nine cwt., equal to twelve hundred and eighty-four bushels of sixty pounds each.

From sixty to one hundred barrels per acre is quite a satisfactory crop for the Southern truck-farmer. The usual mode of planting is in the drill. When in hills, they are made three by two, or three by three, feet apart, and two or three sets are planted in each, so that they may be cultivated both ways. The land being in proper condition, furrows are made by the plow three or three and a half feet apart, into which the manure, if planting is on a large scale, is distributed, at the rate of forty

loads to the acre, by a manure-spreader, and the sets are placed directly upon the manure, at from about twelve to fifteen inches apart. In light, warm land, the sets may at once be covered by the plow to the depth of six inches, and in the subsequent cultivation no hilling up is necessary or advisable. On cool, heavy land, it is advisable to cover at first to the depth of three or four inches, and so early in the stage of growth, as not to injure the roots, an additional inch or two may be drawn to the plants by the hoe. Subsequently the workings by plow and hoe should be superficial. As soon, however, as the first shoots become visible, the surface of the rows should be raked over, to loosen the soil and destroy any germinating or young weeds, or a light harrow may be used some time before the sprouts appear above the ground. A single section of the Thomas-harrow with slanting teeth answers the purpose admirably.

HARVESTING THE CROPS.

A potato is immature and unfit for food, so long as the skin can be readily slipped from the surface. If dug prematurely, they will be bruised and blackened in the barrels, and be unsalable at fair prices. When the plant dies, and not before, the crop may be gathered.

A good plowman may be able with a double-mould plow, or potato-digger, to throw out an extensive and less valuable crop than that of the truck-farmer, without too much loss and bruising, but here a plow should only be used to side the rows and the potatoes be dug out with steel-pronged hoes, or potato-drags.

To avoid unnecessary handling, the potatoes should be assorted as first quality and culls (too small tubers being rejected) in the field. Cloudy weather is the best suited for digging the crop. Potatoes will not endure exposure to the hot sun. If packed while warmed by the sun, they are apt to rot before reaching market. If dug during

sunshine, they should be gathered as dug, carefully emptied into barrels already ventilated, and either promptly hauled from the field, or each barrel shaded by potato vines.

The diggers should not be permitted to bruise the potatoes by pitching them upon piles or distant rows; nor the pickers by throwing them roughly into their baskets. The more carefully a vegetable is handled, the better will it strike the buyer's eye, and consequently, the more money will it bring the grower. Whatever be its size, no cut or bruised potato should be shipped in the first quality, but may be included in the "culls." The barrels must be well shaken down, and so full that the heads have to be pressed upon the contents, and they should be double-headed and strongly coopered.

The crop generally matures in this latitude about the middle of May. An unripe potato in which the starch has been imperfectly formed is slow to dry out and slow to sprout.

THE SECOND CROP.

A sufficient quantity of the "culls" should, therefore, be reserved from the ripest portion of the field for seed of the second crop, and stored in a cool, dry place, excluded from the light. They may be covered on a barn floor in alternate thin layers with very dry sand, or put away in bushel crates.

If exposed to warmth and moisture two or three weeks before planting time, sprouting may be hastened and a better stand be secured. The time to put in the second crop is from the latter part of July to August 10th. If the eyes have sprouted, the tubers should be cut, but otherwise planted whole.

As at this time the weather is warm and the season of growth short, they should be well manured and the land deeply broken up and pulverized to retain mois-

ture. The crop will be matured before frost, which generally occurs about November 1st, when it should be dug and the seed stored away, as recommended above.

DISEASES AND INSECTS.

The fungoid disease, sometimes so destructive to the potato crops of Europe, and of the northern part of this continent, will rarely, if ever, affect our early crops of early varieties, and the later ones must be exempt in consequence of the heat, as cool moisture seems necessary for the development of this disease.

The earliest crops at the North escape great injury from the Colorado Potato-beetle (*Doryphora* 10-*lineata*), and ours will therefore remain exempt from that pest, should it come South. The insects infesting the potato at the South are of the Lepidoptera:

First—*Gortynia nitela* (the Potato-stalk borer).
Second—*Sphinx quinquemaculata* (the Potato-worm).

Among the Coleoptera.

Third—*Baridius trinotatus* (the Potato-stalk weevil).
Fourth—*Lema trilineata* (the Three-lined Leaf-beetle).
Fifth—*Lachnosterna quercina* (the White-grub).
Sixth—*Deloyala clavata* (the Clubbed Tortoise-beetle).
Seventh—*Lytta marginata* (Margined Blister-beetle).
Eighth—*Lytta vittata* (Striped Blister-beetle).
Ninth—*Lytta cinerea* (Ash-grey Blister-beetle).

The first three of these attack the plant only in the larval state.

Numbers 1 and 3 are more injurious than any others, as they devour a vital part, and live within the stalks. The Potato-stalk Borer lives within the stalks of several plants, including the Dahlia and other flowers, and attacks the tomato as well as the potato. When full grown, it enters the earth, and in about two months comes out as a small moth, fig. 50.

The Potato-stalk Weevil lives within the stalk in a similar manner to the borer, but it undergoes its changes

Fig. 50.—THE POTATO-STALK BORER.
Moth. Larva.

within the stem, and finally appears as a small beetle. The different stages are shown in fig. 51. When a vine

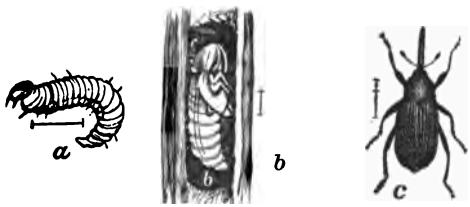


Fig. 51.—THE POTATO STALK WEEVIL.
a, Larva; *b*, Pupa; *c*, Beetle.

is seen to wilt, or to be dying, the stems should be examined for the larvæ, and burnt to prevent an increase of the insect. The worms of the potato and tomato-moth and the other insects, exclusive of the blister-beetles, are not numerous enough to inflict much injury. The Three-lined leaf-beetle feeds upon the plant in its larval and perfect state. The larvæ can be distinguished from any others, by being covered, like the larvæ of the Tortoise-

Fig. 52.—THREE-LINED LEAF BEETLE.
a, Larva; *b*, End of Body; *c*, Pupa; *d*, Eggs.

beetles, by its own excrement, as shown in fig. 52. The perfect insect has a general resemblance to the Striped Cucumber-beetle.

The White Grub is a general feeder, and destroys the roots of many different plants. The larva is shown at fig. 53, and the perfect beetle, the well-known June-bug, in fig. 54.

The principal insect enemies of the sweet-potato are the Tortoise-beetles, of which there are several, some of

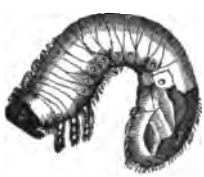


Fig. 53.
WHITE GRUB.

Fig. 54.
JUNE-BUG.

Fig. 55.
CLUBBED TORTOISE-BEETLE.

them of singular beauty. One of them, the Clubbed Tortoise-beetle (*Deloyala clavata*, fig. 55), forms an exception, and selects the common or Irish potato as its food plant, feeding upon it in its perfect state, the larva of this species being unknown.

The Blister-beetles feed upon the foliage in the perfect state only. They are sometimes quite abundant, particularly upon the second crop. Some of the farmers near Savannah were compelled to use Paris green last season, to stay the ravages of *Lytta marginata*.

CHAPTER XXIV.

THE RADISH (*Raphanus sativus*).

Radis and *Rave* French; *Rettig*, German; *Tamme radijs*, Dutch; *Rafano*, Italian; and *Rabano*, Spanish.

The Radish is not known in the wild state, and its native country is doubtful. It is mentioned as being cultivated in England in 1584.

The radish, to be marketable, should not lose its acceptable crispness, and I have, therefore, never heard of its satisfactory cultivation for the Northern markets south of Norfolk.

The varieties there used are: "The Long Scarlet Short Top," and "The Scarlet Turnip," which are sown, as the season will admit, at any time from Christmas to the last of February. A light, mellow soil is best adapted to this crop, as it produces cleaner, nicer radishes, and of better flavor, than a heavier soil. This applies particularly to the longer-rooted varieties. The manure should be deeply plowed under. The field having been plowed in narrow lands and finely harrowed, the seed is sown broadcast at the rate of about twelve pounds to the acre, and covered with a light harrow. The crop is sometimes large enough to be marketable in March, but it is generally shipped throughout April. The radishes are washed, bunched, and packed tightly in ventilated barrels, generally holding about two hundred bunches. The price

Fig. 56.—SCARLET TURNIP-RADISH.

ranges low; but these vegetables sometimes sell as high as eight dollars per barrel. In case of very warm weather, a lump of ice is of late years sometimes packed in the centre of the barrel.

CHAPTER XXV.

SPINACH (*Spinacia oleracea*).

Epinard, French; *Spinat*, German; *Spinagie*, Dutch; *Spinaci*, Italian; *Espinaca*, Spanish.

The common Spinach is an annual plant, supposed to be a native of Western Asia and to have been introduced into England about the commencement of the sixteenth century. Spinach is very extensively used at the North, and when the supply of other green vegetables has been short, that grown at Norfolk has sold for eight dollars per barrel; but the price is very variable. I have never heard of its being grown for the Northern markets, as far south as Charleston. The variety raised at Norfolk is the "Improved Curled American Savoy." The seed is sown from September 10th until October 15th, in drills thirty inches apart, requiring from ten to twelve pounds to the acre. The land must be warm and strong, and the plant requires exceedingly rich manuring. The gardeners at Norfolk supplement their stable manure with Peruvian guano. Some of them add to the heavy manuring given in the fall a top-dressing of a ton to the acre of the best guano. The crop occasionally pays well, but costs the best growers one hundred and fifty dollars per

acre to raise it. When the land is very good, the rows may be only eighteen inches apart. This plant, like the cauliflower, must never be stunted, but be pushed from the start.

When the leaves are about an inch broad, the plants

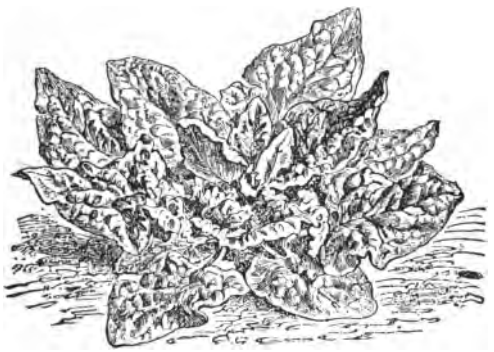


Fig. 57.—SPINACH.

are thinned to from six to eight inches. The crop must be frequently hoed. The Norfolk crop is marketed in March, and is packed tightly in ventilated barrels.

CHAPTER XXVI.

THE SQUASH (*Cucurbita Pepo.*)

Courge Melonée, French ; *Melonenkürbis*, German.

The Squash is a native of the Levant, and was first introduced into England in 1597. The Summer Squash is an early vegetable, bears transportation well, if picked at a proper stage of growth, and brings satisfactory, though never fancy prices. Sometimes, however, a part of the crop may be left on the farmer's hands. With the

large, but late and unproductive winter squashes, the truck-farmer has no concern. Of the early summer squashes the two varieties cultivated for the Northern

Fig. 58.—SQUASH—WHITE BUSH SCALLOP.

markets are: the "Early White Bush Scallop," fig. 58, and the "Early Summer Crook-neck," fig. 59.

The latter is much the best flavored of all the bush squashes. It is of a dark orange color and is covered with warty excrescences. When sufficiently grown for

Fig. 59.—SQUASH—SUMMER CROOK-NECK.

shipment, it is about ten inches long. Although this may sometimes be preferred, and occasionally command a better price, the scallop squash is the favorite, as it bears transportation and is packed much better. The

"Boston Marrow" and "Hubbard" have recently been grown for shipment. These are winter, running varieties, and must be planted from eight to ten feet apart. If one saves his own squash seed, he must avoid having any others of the same family growing near by.

SOIL AND CULTIVATION.

The squash is a little more hardy than the melon and cucumber, and is planted from about the last of February up to the middle of March, in the latitude of Savannah, and, of course, earlier to the southward. This crop requires a light, warm soil, and liberal manuring, particularly when planted so early. It is usually grown in hills four or five feet apart each way, the manure being dug in somewhat, as recommended for melons, at the rate of two shovelfuls to the hill. From six to ten seeds are sown to each hill, and the plants thinned to a stand after the development of a couple of rough leaves.

Instead of growing in the hill, and leaving two plants in each as is usually practised, I prefer to manure in the drill, to sow the seed at two feet apart, and to leave, finally, but a single plant every two feet. If sown as early as March 1st, it is advisable to make at least a second sowing. The cultivation is the same as for cucumbers.

MARKETING.

If squashes intended for shipment to the Northern markets, were to be picked, or rather cut (for they should never be broken from the plant) in as green and tender condition, as for the local demand, they would arrive at their destination, bruised, blackened, and unsalable. Even if they could be delivered in sound condition, squashes in such an early stage of growth would not suit the trade. The proper time to pick them is when they have nearly attained their full growth, and for the scallop variety, just as they have lost the green, and are acquiring

a white and glossy appearance. At this time the rind is still penetrable by the finger nail.

Squashes may be shipped either in barrels or crates, and they must be so carefully packed as not to be bruised during transportation.

INSECTS.

The insects infesting the squash plant, besides the already mentioned striped-bug (*Diabrotica vittata*), which is more frequently on the cucumber, are:

First—The Twelve-spotted Squash-beetle (*Diabrotica 12-punctata*).

Second—The Squash-bug (*Anasa tristis*).

Third—The Squash vine-borer (*Ægeria cucurbitæ*).

Fourth—The Melon-worm (*Phacellura hyalinitalis*).

Fifth—The Squash Lady-bird (*Coccinella borealis*).

The injuries inflicted by, and the remedies applicable to the twelve-spotted squash-beetle, and the cucumber-beetle or striped-bug, are identical and are described under "Cucumber."

The offensively smelling, rusty-black colored, hemipterous "squash-bug" affects the plant in the larval and perfect state. It destroys the leaves in a manner similar to the harlequin cabbage-bug, by sucking out their juice. The yellowish brown eggs are laid in little clusters on the underside of the leaves. Both eggs and insects are readily detected, and may be hand-picked. The squash vine-borer lives, and inflicts its injury within the stem of the plant. The first indication of its presence is the wilting of the vine. The larvæ may be killed by destroying such vines, to prevent the increase of the insect. The melon-worm (see "Melon") only attacks the later crop of squashes, and should be destroyed whenever found. The squash lady-bird, is the only species of the Coccinellidæ which does not befriend the farmer. This insect feeds both in its larval and perfect state upon the

leaves of the squash. The eggs are deposited in groups on the under surface of the leaves. The color is dull yellow with nineteen black spots on the thorax and wing covers. Hand-picking is the remedy.

CHAPTER XXVII.

SWEET-POTATO (*Ipomœa Batatas*).

Patate, French; *Süsze Kartoffel*, German.

The native country of the Sweet-potato is unknown, some authors accrediting it to America, and others to the East Indies. It was used as a delicacy in England, long before the Irish potato was known, it having been imported from Spain. The plant was introduced into England by Gerarde in 1597. Were it not for the fact that the taste for this potato and the manner of cooking it at the North differ so much from that common at the South, the sweet-potato could be made a very profitable crop. Here it is baked, while at the North it is usually boiled. The most salable, and, in fact, the only extensively marketable variety in any of the Northern markets, is the "Delaware," "Jersey," or, more correctly, the "Nansemond," (at one time called the "Brimstone"), which at the South is regarded as a most inferior sort, unfit for the table, unsalable in local markets, and, in consequence of its unproductiveness, unsuitable for cultivation. While boiling will make any of the Yam varieties mushy, baking renders the Nansemond like so much dry flour. Although I have several times received nine dollars and ten dollars per barrel for the Nansemond of the first quality, in Boston and Baltimore,

I have for years abandoned the crop. Many of the tubers do not attain a marketable size in time to anticipate the Virginia crop, or before August 1st, and therefore the whole fails to be remunerative. The other varieties produce few, but uniformly large, potatoes, while the Nansemond has a great number of small ones. Still, circumstances may alter the case, and others may succeed better with this variety than I have done. The sweet-potato would be then a profitable crop. The other varieties may produce from two hundred to eight hundred bushels to the acre; but several of the Yam varieties split open and become useless when highly manured and grown to a large size, say from two to six pounds. This objection does not apply to the Pumpkin Yam, which is also a productive and good table potato for home use.

RAISING THE "DRAWS" OR SETS.

The sweet-potato is propagated by "draws" (or "slips" in the up country, and "sets" or plants at the North), by "roots," as the Irish potato, and by "slips" or cuttings of the vines taken from the growing plants.

The crop of the truck-farmer is grown only by "draws." The chief danger in producing these consists in killing the eyes by exposing them to too much heat. In this latitude, and further South, they are more safely grown in cold-frames, prepared about the last of January. The light, warm soil of a cold frame having been dug up, raked, and leveled, the seed potatoes are placed on the surface, a half-inch or so apart. Specimens of more than about two and a half inches in diameter may be divided in two, lengthwise, and the halves laid on the bed with the cut surface down.

If the weather and the soil are dry, the potatoes may be watered and then covered evenly with about three and a half inches of light soil. The soil will settle a little. The frames should never be closely covered with the sash,

even at night, except in cold weather, and never in bright sunshine. In dry weather, the soil may require watering.

In case the draws are well grown, even commencing to "run" and crowd each other, before the season admits of their being transferred to the open ground, they may be drawn and heeled-in closely in another cold frame, to await favorable weather. In the meantime other sprouts will form for another pulling. To heel them in most expeditiously, a wedge-shaped opening is made across the bed, by plunging the spade into the moist soil to its full depth, and pushing it backwards and forwards. Such a drill will hold several hundred plants. The opening of the next drill, five or six inches distant, will press the soil to the roots of the plants in the first drill. They may be put out as soon as danger from frost is supposed to be past; in this latitude about April 1st, and earlier at the Southward. They may, however, precede other tender plants, for a hoar frost will not kill potato draws outright if they were properly transplanted. The soil best adapted to the sweet-potato is a warm, well-drained, light, sandy loam, or pure sand.

PREPARING THE SOIL.

This is an exception to all other vegetables, inasmuch that the soil should not be deeply stirred. A hard bottom to the row is needed to induce a short, plump growth of the potatoes. On deeply plowed, sandy soil, on a porous subsoil, the "Yellow Red" variety has grown over a yard in length and but an inch or less in diameter, and very few well-shaped potatoes were in a crop. If the surface is to be stirred, it should be done by a small plow as superficially as possible, or by means of a horse-hoe. The old-fashioned "listing," where the plants are to be put out on an elevated ridge, or bed, is the best preparation, the only objection being, that in case it is necessary

to cover in much vegetable matter, the beds must be made high, in order to furnish soil enough in which to set the plants. Further North such beds are necessary; but for this latitude and to the Southward, on light, warm, well-drained soils, I disapprove of high, pointed beds, because of their drying out so rapidly. The Nansemond will not thrive in heat and dryness. Well-rotted stable or cow-pen manure, or a good compost, should be spread upon the list at the rate of twenty-five loads to the acre, and covered by the plow. On clean land, without any list, it is spread on the surface in rows, three and a half feet apart, and covered with soil. The ridges should be raked down to within a few inches above the general surface.

Potash is especially needed in the soil for this crop. The best manuring that can be given to land for the sweet-potato is by cow-penning it. Apart from the adaptability of the manure for the needs of the crop, a special benefit results from the compacting of the soil by the trampling of the cattle.

No variety produces a more satisfactory draw than the Nansemond. It has more abundant and longer roots than any other, which may be more readily pulled from the potato without disturbing it in the bed.

TRANSPLANTING.

The draws are put out with a trowel, or a flat or round dibble, on the tops of the ridges, about fifteen inches apart, and inserted one or two joints deeper than they originally grew. They are thus not only likely to bear better, but are safer from injury by a severe white frost; they will not be killed outright, but will sprout again from the buds on the stems that are below the surface. In subsequent culture, superficial hoeing, with one plowing, as the vines commence to run, will suffice, care being observed never to cover any part of a vine.

DIGGING THE CROP.

When the crop is to be dug, if the vines are not very abundant (a luxuriant growth above ground is by no means a sure indication of a good crop below it), they may be torn away by the plow, the point not being permitted to enter the ground. This is only practicable with the Nansemond and other small-vined varieties. The "Peabody," "White Yam," and some others, have vines that are too thick and strong. If the growth is too heavy, they must be stripped with sharp hoes; when the rows may be sided by the plow and the crop dug with steel prong-hoes. The gathering, assorting, and packing are the same as in the case of the Irish potato, with the exception that sweet potatoes are less susceptible of injury by sunshine, and they may be exposed long enough for the soil to become dry and rub off in the handling.

POTATOES FOR SEED.

The proper time to put up seed potatoes for the next crop is as late as possible in the fall, or after the first white frost has touched the leaves. The opinion generally prevails that potatoes grown from draws will not keep well. Probably it is so, only because such are over-ripe. Seed potatoes are saved from plantings of slips or cuttings. The earlier they can be made, as soon as the vines have grown long enough and the weather is sufficiently wet, generally in this latitude about June 1st, the better. The longest, and, therefore, hardiest vines being selected, an evenly laid bundle as large as the hand can grasp is placed on a board, and cut with a sharp hatchet in lengths of about fifteen or eighteen inches, rejecting the delicate end pieces. These cuttings are laid across the ridges at twelve or fifteen inches apart, and pressed down into the soil by means of a

notched dibble (figure 60). The vine is fixed about its middle in the notch, thus making, as it were, a double cutting. If vines are scarce, single cuttings may be made of four or five joints, the lower three leaves being cut away. These may be planted with a common dibble.

The cultivation is the same as before. The seed may be preserved in a dry cellar, but is usually put up in potato banks. The surface in a dry situation is leveled and covered to the depth of four of five inches, with dry pine straw; the potatoes are placed upon this, storing not more than fifteen or twenty bushels in each bank. Pile them in as sharp a cone as possible, and cover first with pine straw, then closely with corn stalks, in order to shed the rains, and finally with five or six inches of soil. This covering will absorb the moisture which escapes from the potatoes, but large banks should be provided with a ventilating hole at the top, the admission of rain water being prevented by a cover.

Fig. 60.—SWEET-POTATO DIBBLE.

INSECTS.

The insects that attack the sweet-potato are:

First.—*Haltica cucumeris,* (Cucumber Flea-beetle).

Second.—*Sphinx cingulata,* (Sweet-potato-moth).

Third—*Cassida bivittata,* (Two-striped Tortoise-beetle).

Fourth.—*Cassida aurichalcea,* (Golden Tortoise-beetle).

Fifth.—*Cassida guttata,* (Mottled Tortoise-beetle).

Sixth—*Cassida nigripes,* (Black-legged Tortoise-beetle).

Seventh.—*Chelymorpha cassidea.*

The first-named and smallest of these (described under "Cucumber") is the most injurious, attacking the few leaves of the young plants as soon as they are put out. The remedy for the flea-beetles,—dusting with lime, soot, or Paris green—if very abundant, may be resorted to.

The large green worm of the sweet-potato-moth (*Sphinx cingulata*) very much resembles the tomato-

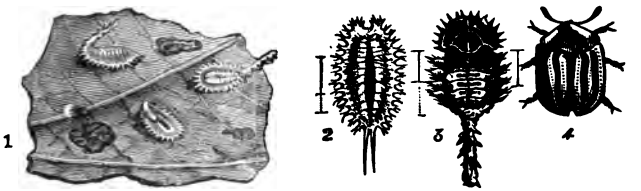


Fig. 61.—TWO-STRIPED TORTOISE-BEETLE (*Cassida bivittata*).
1, Larva, natural size; 2, Larva; 3, Pupa; 4, Beetle, all magnified.

worm, but is not in sufficient force to do much injury. The moth is especially distinguished from *Sphinx Carolina*

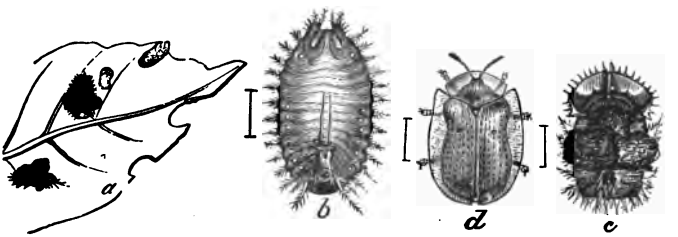


Fig. 62.—GOLDEN TORTOISE-BEETLE (*Cassida aurichalcea*).
a, Larva, natural size; *b*, enlarged, with dung removed; *c*, Pupa; *d*, Beetle.

and *Sphinx quinquemaculata* by its pink-striped underwings. The larvæ of the tortoise-beetles, although some-

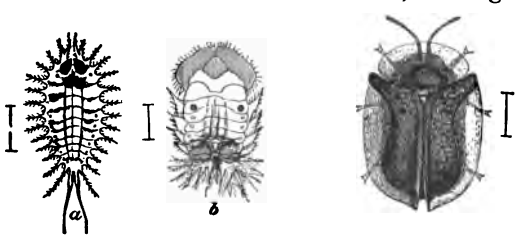


Fig. 63.—MOTTLED TORTOISE-BEETLE (*Cassida guttata*).
a, Larva; *b*, Pupa.

times abundant, are not sufficiently so to diminish the crop of the truck-farmer. They have, like those of

Lema trilineata, the peculiar habit of covering themselves with their own excrement.

The past season, I noticed, for the first time, a number of the perfect insects of *Chelymorpha cassidea* feeding upon the sweet-potato. It is said to feed upon the milk-weed, and, I believe, has been found on the wild convolvulus, or morning glory. It is a yellow, oblong-oval, beetle, somewhat similar to the tortoise-beetle in form, about three-eighths of an inch long, with a pair of black dots on each side of the thorax, and six black spots on each wing-cover.

CHAPTER XXVIII.

THE TOMATO (*Lycopersicum esculentum*).

Tomate, French; *Liebes-Apfel*, German; *Appeltjes des liefde*, Dutch; *Pomo d'oro*, Italian; *Tomates*, Spanish.

The order *Solanaceæ* or Nightshade family contains over twelve hundred species, among which are three of our most wholesome and important vegetables—the Irish potato, the tomato, and the egg-plant. It also includes the red pepper and the narcotics, bittersweet, belladonna, Jamestown or "Jimson weed," the tobacco and others.

The Tomato was first introduced into Europe from South America in 1596; but for many years it was exclusively cultivated as an ornament to the flower-garden. It came very gradually into use in the preparation of sauces and in soups, having attained popularity only within the last forty years. In the north of the European continent and in England it is not yet popularized; while in France and Italy, particularly near Rome and Naples,

it is produced in large quantities. It is a strange fact that, in Sicily, the tomato, when ripe, becomes sour and so unfit for use that the island has to be supplied from the vicinity of Naples on the neighboring mainland.

Like all vegetables, grown on such an extensive scale, and so well adapted for transportation to distant markets, the prices the tomato commands are very variable. The farm-gardeners on Long Island and other points in the vicinity of New York rarely receive better prices than from twenty-five cents to one dollar per bushel, while fine stock arriving early on a bare market, has occasionally brought very high prices. Thus, some years ago, I received sixteen dollars per bushel-crate in Baltimore (at the rate of eight cents each), and in Boston and Baltimore, which are the best markets for this vegetable, I have frequently received eight and ten dollars per bushel-crate. Now that Florida anticipates more Northern localities in shipping tomatoes (though very frequently of inferior quality, sufficient care not having been paid to assorting and packing), these prices are past. The returns now range between one dollar and fifty cents and five dollars per crate, according to the length of the shipping season. The yield is from one hundred to two hundred crates per acre. At the North, where five thousand plants are required to the acre, and where the bearing and picking season is longer, four hundred bushels are obtainable.

VARIETIES.

The great number of varieties enumerated in seed catalogues has only interest for the amateur. There is little or no difference in the time of maturing the fruit, whatever claim may be made in the advertisements. This is probably owing to the neglect to save seed repeatedly from the choicest and earliest fruit. A good market variety should be of medium size, round and smooth, with few

seeds; it must be firm, must ripen evenly and have a bright red color. The "Acme," "Livingston's Beauty" and "Perfection," the "Round Smooth Red," and the "Hathaway" fill these requirements; the first-named is at present preferred. The "Trophy" and "Fejee Island" are both of excellent quality and appearance, but the first is objectionable on account of its too great size (not satisfactorily measurable by the quart), and the latter on account of its shape. The "Pear-shaped" and the "Yellow" and "Red Cherry" are only used for pickles and preserves.

SELECTION OF SOIL.

The tomato will better resist drouth than it will too much rain, and indeed better than most vegetables; the soil, therefore, best adapted to this crop is a sandy one, or a high sandy loam. On low ground, well drained or not, in dry or wet seasons, the plants are liable to die out about the commencement of bearing. The fruit will even rot on high sandy soil, when the plants are manured with muck that has been exposed to the atmosphere for eight months. The tomato is not a gross feeder; it prefers a poor soil to one that is too fertile, nor will the plant bear any considerable application of stimulating fertilizers, such as Peruvian guano, hoof-trimmings, fish scrap, etc., which will certainly cause it to run to vine, and to make the fruit, particularly the first, decay before attaining full size. Those which do mature will be watery and not carry well. A good crop can be made with one shovelful of well-rotted stable or cow manure, or good compost, to the hill, or upon a soil which has recently produced a well manured crop. In the last case no manuring would be needed.

SOWING THE SEED.

Slow growth being requisite to produce good stocky plants, the seed should be sown about January 1st on un-

manured soil, in cold frames, in drills across the beds four inches apart; and earlier or later, according to the degree of latitude south or north of Savannah. On heavier soils, use a slight bottom heat, light manuring, and sow ten days earlier. If, after sowing, the weather should be cold and cloudy, the ground should be kept warm by means of the glass; but if warm, with much sunshine, the frames must be kept open or shaded, and the soil moist, until the plants have come up. Under the shade and moisture of the front boards of the frame the plants are apt to damp off, and to grow small and slender under the reflection of the sun near the back. It is therefore advisable to sow the seed more thinly near the front and back than in the middle of the bed. To avoid a too spindling and crowded growth, the plants should be thinned as soon as they are large enough to be handled with safety, and transplanted to fill vacant spaces in other cold frames, or thrown away. A tomato plant should never be put out in the open field, if avoidable, without having been previously transplanted. When the plant is pricked out deeper than it stood in the seed bed, it will throw out numerous small fibrous roots along the stem and at the root, to which the soil will adhere, when again taken up; and will therefore be apt to suffer less check at the final transplanting. When about four inches high, near the middle of February, pricking out into other cold frames, with the soil as in the seed bed, should be commenced. Set the plants down to the seed leaves at three or four inches apart, or if very large plants are desired, more space may be allowed to each. At those distances, each three by six-foot sash will cover from one hundred and sixty-five to two hundred and ninety plants, and an acre will require the use of at least eleven sashes. A very stocky growth can be obtained by stopping or cutting off the tops of the plants just above the seed leaves, as soon as vigorous growth has commenced. They

will throw out a stem at the axil of each seed leaf; thus producing, as it were, two plants from each root, which, when planted out deeply, will support each other and tend to increase the yield. If this is done before the plants have taken root, only one bud is likely to develop. If the pricked out plants become too crowded, pinch

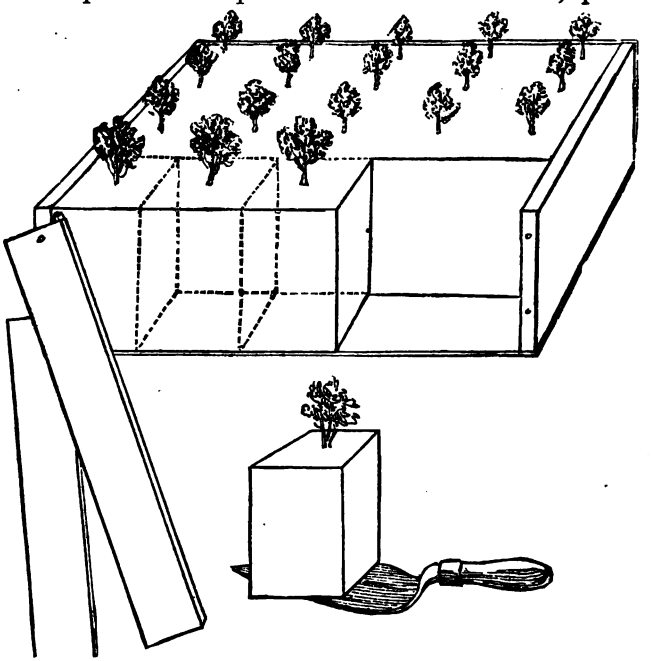


Fig. 64.—BOX FOR TOMATO PLANTS.

off some of the lower leaves to promote a stockier growth and cause side shoots to push. It may pay those, who can ship the earliest tomatoes, to prick out into pots or into boxes, plunging the boxes in cold frames.

BOXES FOR TOMATO PLANTS.

Before shipments from Florida by their greater earliness anticipated my crops of Tomatoes, I used boxes like

those in fig. 64, holding twenty plants each. These measured twenty-three and three-fourths by eighteen inches by seven inches high; they were made with two end boards eighteen by seven inches, and three-inch laths twenty-three and three-fourths inches long. When made of these dimensions and placed in contact in rows of three boxes across the bed, a cold frame six feet wide will rest with its upper and lower edges upon the adjoining end boards of the boxes. The boxes may be less than seven inches deep. They are filled with soil which has been screened or is naturally free from roots, sticks, pebbles, etc. Before removal from the frames, the soil must be saturated with water, when the plants can be cut out in the field with a sharp-edged brick-layer's trowel and placed with blocks of soil adhering to the roots, in squares previously made by the plow, using a double mould-board. A hoeful of soil drawn to each side of the plant finishes the planting. In this manner plants may be put out on the highest ground, in the driest weather, and during the hottest midday sunshine, without wilting or the slightest apparent check to growth.

TRANSPLANTING.

If, however, the plants pricked out into cold frames are taken up carefully, with as much moistened soil adhering to the roots as possible, they may be planted out with the dibble or trowel, without loss, when the soil is only moist enough for the holes to be made, the recommendations given in the chapter on "Transplanting," being closely observed.

The distances at which the plants are put out will depend upon the fertility of the land and the variety; the usual distances are three to three and one-half feet in the rows, which are from four to six feet apart. The season and danger of frost will determine when to put out the plants, which is about April 1st. A tomato plant,

however, if of stocky growth, will resist a slight frost, and the earlier it can be put out the better. If white frost be apprehended, the plants may be protected when grown on a small scale, by means of boxes or any other screen, or by smoke; but when on a large scale it is cheaper to have a surplus on hand, in case of loss by frost.

CULTIVATION.

The first workings are done with a cultivator or a horse-hoe, running both ways. The plow and hoe leave the crop free from weeds, and on wide beds, at the time picking commences, the soil will be well drawn up to the stems, but without having covered up the young shoots issuing from the main stem, and which will bear fruit. Training the vines to a single pole or to two placed parallel, or to a trellis, may be practiced on a small scale. Pruning the vines is not advisable. The fruit matures in this latitude about June 1st. Below is a table showing the dates of sowing, pricking out, planting and harvest for seven consecutive years:

Dates of sowing.	of pricking out.	of planting.	of harvest.
Jan. 14.	Feb. 15.	March 27.	June 5.
Jan. 14.	Feb. 17.	March 16.	June 7.
Jan. 9.	Feb. 20.	March 26.	June 3.
Jan. 4.	Feb. 26.	April 1.	May 30.
Jan. 5.	Feb. 28.	March 24.	May 22.
Jan. 8.	Feb. 12.	April 1.	May 28.
Dec. 19.	Feb. 12.	March 19.	May 31.

PICKING AND PACKING.

The distance from market, or time required in transportation, will determine the stage of ripeness at which the fruit is to be picked. Fruit exposed fairly to the sun will show the commencement of the ripening process on the upper surface, while that in the dense shade of luxuriant foliage will first redden on the flower end. In the vicinity of Charleston and Savannah, the proper stage has been reached, when the tomato has attained a yellow cast; and in Florida, as soon as it is full-grown and

shows the least sign of "turning." Generally the picking is done there, when the tomato is much too green to ripen properly, and at the cost of the producer. The pickers should not place leaky or decaying fruit in their baskets to soil the rest. Tomatoes, like all other stock for which good prices are expected, should be carefully assorted, both as to quality and degree of ripeness, all inferior or worm-eaten fruit being strictly excluded. Tomatoes should not be emptied out of the baskets into the crates and shaken down like potatoes, but packed singly, in order that they may lie compactly, so that upon arrival in market, each package may present a full and unshaken appearance. In the more careful packing practised in later years, the fruit has been wrapped in paper. This wrapping protects the remainder of the fruit from leaking or decay in the crate. Paper for the purpose should be porous, soft and strong. Pieces seven inches square (forty-nine square inches) will answer for fruit of medium size.

A tomato as it is picked from the plant may frequently present a perfectly sound appearance, until the stem is removed, when it is found to contain a well-grown worm of *Heliothis armigera* the Cotton-boll worm; the insect, while very small, having penetrated the fruit under the calyx. A reason for rubbing off all the stems, is, the danger of their bruising other fruit or tearing the wrapping paper. In our Southern climate, an early tomato plant will not continue in bearing beyond the first part of August; but a succession may be secured by putting out plants in July from seed sown in May, or early in June. From this crop, grown in hot weather, however, neither the yield nor the size of the fruit will be as satisfactory as the earlier one. Plants may also be propagated from cuttings of old vines, if set out in moist ground; but many frequently fail to take root.

SAVING THE SEEDS.

For seed, the earliest well-matured, and in every respect, the choicest fruit should be selected, and those which were grown on soil best adapted to the tomato. As the objectionable knobby fruit is produced from double flowers, and these are said to result from the use of old seed, the fruit from which to save seed should only be gathered from plants raised from fresh seed. The fruit, when soft and over-ripe, should be mashed in any convenient vessel and stirred daily for three or four days, when the seed may be washed from the pulp and dried.

INSECTS.

Young tomato plants are liable to be cut down by several kinds of cut-worms.* During the Spring of 1882, the green larvæ of *Sphinx Carolina*, and *Sphinx quinquemaculata* were very numerous and destructive; but generally, owing to paucity of number, the damage is slight. More severe injury is done, and particularly to the earlier and therefore most valuable part of the crop, by the caterpillar of the Cotton-boll worm, (or the "Corn-seed worm," *Heliothis armigera.*) They rarely, and only when very young, touch the leaves; but penetrate the green fruit, one worm often boring into several. Hand-picking in either case is the only remedy. Just before the first picking for market, all the punctured fruit should be gathered and either fed to the stock or destroyed.

Sometimes a large green worm may be found with one or two of what appear to be very minute eggs, adhering tightly to the skin at one of the rings of the body, or covered apparently, with eggs. Such a worm should not be destroyed. The supposed eggs are the chrysalides of an Ichneumon fly, its appropriate insect enemy.

*See Chapter on Insects.

CHAPTER XXIX.

THE WATERMELON (*Citrullus vulgaris*).

Pasteque, French; *Wasser-Melone*, German; *Water meloen*, Dutch *Cocomero*, Italian.

The Watermelon was probably the melon of the Bible, and, as has been incidentally stated, was known to the Jews in Egypt.

Watermelons may be more or less successfully grown from Key West to New Jersey, and from as far south in the interior of Florida as transportation facilities enable the farmers to ship the crop profitably. Commencing about May 15th, they are forwarded to the North by steamships and to the North-west by rail.

Owing to the size and nature of the fruit, it has to be shipped in bulk, and, even with careful handling, in transit, accidental breakages will occur; but, if the entire crop, exclusive of losses by unavoidable causes, could reach the market, none would, under favorable circumstances, pay better.*

* The losses upon watermelons shipped to Boston have been so general that the subject has been discussed by the "Vegetable and Fruit Growers' Association," with a view to provide a remedy. G. R. McRee, Esq., of Lowndes County, Georgia, one of the largest growers of melons for shipment to the North, wrote to the author in September last as follows: "I have almost quit shipping to Boston on account of the heavy losses. I have lost as much as fifty per cent. of some of my consignments, and never expect to get off with less than twenty per cent."—In December last Mr. McRee wrote: "You are at liberty to use any statement from me, in reference to the loss on steamers, in your forthcoming work. My losses by the Boston ships have been so heavy that I have very nearly quit the line. I sent only two or three consignments by it the past season, and these were shipped by the forwarding agent of the railroad because the New York ship was missed."

LATER NOTE.—I am constrained by a sense of justice, to state that after the above was in type, the agents called upon me, as President of the "Vegetable and Fruit Growers' Association of Chatham County," and promised that at both ends of the line, with the finer ships and new staffs of officers and crews, they would endeavor to remove the cause of complaint.—A. O.

AVOIDABLE LOSSES.

The melon, like most other plants, is subject to insect depredations; but it is not from losses to the farmer by these minute objects, nor by the unfavorableness of seasons (although the melon is among the most uncertain of crops), nor by any of the other contingencies which so often make the profits of the agriculturist doubtful, that his success and his income are diminished; but by depredations and theft. After his crop is harvested, quick and safe transportation to market is a chief factor in successful truck-farming. Without it the industry must fail.

With the transportation lines from Savannah, I have had an experience of twenty-seven years. In that time I have been the largest, and am now the oldest grower of melons in this immediate region, and know whereof I write. Previous to the war, the pilfering of melons was carried on to such an extent that two Sea Island cotton planters, my relatives, who planted them most extensively, were by self-protection compelled to admit the captains, or pursers of the steamships, into co-partnership, allowing them a part of the profits. Then, and then only, could melons be shipped with safety. Since that time, a vast improvement has been made. If it be a difficult matter to prevent these losses to the shipper, the agency shows a praiseworthy endeavor to curtail them, and there seems to be a fair prospect of still further future improvement.

The two Northern markets, where melons invariably command the highest prices, are Boston and New York. Under the same conditions of safety the preference would be decidedly in favor of the former; but the handling has been so careless, and the "shortage" so outrageous, as to discourage shipments to that market.

I have lost as many as two hundred and twenty-nine

melons from a single shipment. The great loss is not under the head of specked or decayed (principally owing to rough handling), but missing. The melon is not an evanescent object which disappears without trace like exploded gun-cotton.

A fair yield to the acre is one thousand melons, large enough for shipment, or ranging from fifteen pounds upwards. In consequence of a disease which has been killing the vines of late years, about the time the fruit is forming, the crop more frequently falls below than exceeds that number. I have examined the roots and vines in

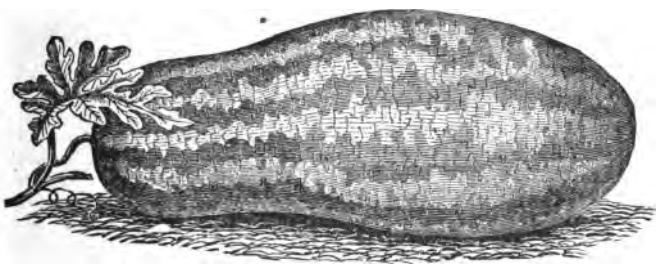


Fig. 65.—WATERMELON—"RATTLESNAKE."

vain for insects, to account for this disease, and have not yet been able to ascertain the cause.

It is probably not attributable to an insect in the root, like the larvæ of the striped-bug in the cucumber, for the disease sometimes first manifests itself in a single side-runner.

My melons sold the past season in the New York and Boston markets at from twenty-five to fifty dollars per hundred.

VARIETIES.

A variety to be fit for shipment should be large, with a rind thick enough to carry well, should not "burn" or become discolored in the field by the hot sun, and should "cut" red throughout, without a lighter colored hard

"core." At present "Kolb's Gem," and the "Rattlesnake," which is also known by several local names, fill these requirements better than any other.

SOIL AND PREPARATION.

The soil best adapted to the watermelon is a light, dry, warm sand, lately cleared, or which has not been cultivated for at least three years.

This peculiar adaptability of new ground is probably attributable to the opening of the soil by the decaying roots of vegetation. Whatever compacts the soil is injurious to the crop. A rainy season, owing partly to the consolidating of the land, is most unfavorable to success. On new ground, the first formed young fruit are more apt to become developed, and in larger numbers, and particularly are they all liable to shrivel and drop off on old recently cultivated land after a heavy rain or frequent lighter ones. This applies particularly to the sandy land of the coast. Notwithstanding the very succulent character of the fruit, wet weather is more damaging than drouth.

The field having been plowed and harrowed, it is laid off, according to the usual custom, ten or twelve feet each way, to mark the hills. For this purpose, a double mould-board plow is the best implement. It makes straight smooth furrows and wider openings at their crossings for the hills. Instead of these distances I prefer to make my hills six by twelve feet apart, and leave but a single plant in each, rather than two plants. With the same average area for each vine I conceive that the single plants will produce a greater number of large melons to the acre. The openings made by the plow are enlarged to about three feet in diameter, and deepened below the depth of the surface soil, and one or two shovelfuls of decayed stable, cow or hog manure, the latter to be preferred, are dug up and intimately mixed with the sub-

soil, by means of hoe, spade, or digging-fork. The hoe, although not so effective, is the more expeditious tool in the hands of negro laborers. Green stable manure or any other kind that is fermenting, or heating, is not suitable for melons on light land. If in place of the above, a compost of muck or woods-earth with cotton-seed meal or fish guano is used, the quantity should be two shovelfuls, containing about one pound of the meal or guano. When manure is plentiful enough, it may be applied in the drill or even broadcast, notwithstanding the distances of the plants, for most of the roots of the melon plant are long surface roots. Manured only in the hill, the plant derives less benefit from the fertilizer.

SOWING THE SEED.

A flat hill, elevated two or three inches above the general surface, is made over the manure with the removed surface soil, and in the middle of each the first sowing of from six to ten seeds is made, one or two inches deep, according to the nature and degree of moisture of the soil. As in the case of cucumbers, I make two more sowings at intervals of a week, putting in three or four seeds at each, at which rate it will require from two and one-half to three pounds of seed per acre. A temperature of about sixty-five degrees is required to sprout melon seed; and there is rarely anything gained in this crop by making the sowings too early, as cold weather, even without frost at night, will give the plants a check from which they will never recover sufficiently to produce a good crop. While melon seeds may be planted in the middle of Florida, in January and February, March 15th is quite early enough for the first planting in the latitude of Savannah, and, of course, later further North.

CULTIVATION.

If the first sowing has failed, or the plants have been killed or injured by cold, it is best to await the growth

of the second or even of the third planting; otherwise, as soon as the first has made two rough leaves, and the others are up, the top of the hill should be stirred by a hand-weeder, or other hand implement, or by the fingers; and the loose soil drawn to the stems up to the seed-leaves, at the same time thinning the plants to a couple, of each sowing, or even to less, if they crowd each other. Of course, the strongest, healthiest looking plants are to be left. It is sometimes the case that plants from the second sowing are more advanced than those from the first, when all of the latter should be removed. To stir the soil and destroy young weeds, the cultivator or horse-hoe is run in both directions over the whole surface, and as near the hills as possible without disturbing them. They should be thinned to a stand early enough to prevent crowding, and the hills hoed about the time the plants commence to "run," and the soil drawn well up to the seed-leaves, great care being taken not to cover the leaves or crown. Before the vines reach the edge of the hills, two furrows should be thrown to each side of the row. It requires careful plowing to throw the soil to the middle without disturbing the hills, which are only six feet apart. This is done by depressing the right handle of the plow, or pushing it inward to the rows as the plow reaches each hill, and erecting it again in passing. Melon vines should never be handled, if it can possibly be avoided, and, therefore, as the vines cover the bed, and before they extend beyond it, the plow is used repeatedly, until the plants are left on wide beds separated by a wide furrow. Before the second plowing, hoes should be carefully used around the hills and between the vines without touching them rudely; removing all weeds before overlooked. Watermelons come into market from Florida about the latter part of May; and from the vicinity of Savannah and the adjacent Sea Islands, about July 1st.

GATHERING THE FRUIT.

An experienced picker can recognize from its general light and bright, but not glistening appearance, when a melon has reached a proper state to be cut from the vine for shipment, before it is fully, or "red" ripe, and he may do so without any other loss of time than is required to detach it from the vine and to place it on end for the carriers. Roads should be convenient, for it is impossible to induce the laborers to avoid treading on the vines, even when they do not cover the ground. The less experienced pickers must look for other signs of ripening, and the "belly," or lower surface, where it has been in contact with the earth, presents the most reliable in the appearance of the pores of the skin. When these become perceptible to the touch, by a roughness of the skin, or can be seen, or the rind has become too hard to be readily indented by the finger nail, the melon may be picked for shipment.

The shriveling or dying of the "curl," or little tendril nearest to the melon, or in the axil of the stem, is a usual, but not a certain rign of ripeness.

A ripe melon sounds hollow upon percussion with the knuckle; but thumping is only practicable in the early morning, for a large unripe melon has the same resonance during the hot midday sun. If the "belly" is yellow and blistered the melon is surely full ripe. Pressure upon the fruit to hear the sound of the rupture of the flesh within, if ripe, is objectionable. It injures the ripe as well as the green, and should never be resorted to.

INSECTS.

It is possible, nay, even probable, that the late, generally observed perishing of melon vines may be entirely attributable to insects, and in part, to an unknown one. Wire-worms, or larvæ of *Diabroticæ*, may be the cause of the death of some.

The injury to the seed-leaves of young plants by flea-beetles is annoying, but never extensive enough to warrant the application of a remedy over the large area of a melon crop. Of the several plants in each hill a vigorous one may be expected to escape injury, until the development of rough leaves, when the danger from this source ceases.

The watermelon is a food plant of the yellowish green, nearly translucent larva of an insect very similar to the pickle-worm moth, *Phacellura hyalinitalis*. If this insect has two broods, the first, or spring brood, must be very limited in numbers; for I have never known the early melon crop for shipment to be damaged, while later crops suffer very severely. Not only are the leaves devoured, but the worms gnaw and penetrate the fruit. It is, of course, the policy of the farmer to destroy the insects in all its stages, whenever possible; but no remedy has as yet been found that can be profitably applied. The *Phacellura* is known to be subject to two parasitic insects: the *Pimpla conquisitor*, and a Tachina fly.

CHAPTER XXX.

THE STRAWBERRY (*Fragaria*).

Fraisier, French; *Erdbeere*, German; *Aardbezie*, Dutch; *Pianta di fragola*, Italian; and *Fresa*, Spanish.

The Strawberry, with the majority of the cultivated fruits of Northern climates, belongs to the Rose family. It well deserves its botanical name, *Fragaria* (from *fragro*, to emit a sweet odor), for no other fruit is so fragrant. While some who have written upon the straw-

berry make nearly a dozen species, the most accurate botanists fail to find more than three or four, that are really distinct. The most widely distributed species is *Fragaria vesca*, the Wood or Alpine strawberry. In this the seeds (really one-seeded seed-vessels) are not sunken in a cavity in the fruit, but are prominent upon the surface. This is the most widely distributed species, being found wild in Europe, Asia, and in this country. From this are derived all the cultivated Alpine strawberries, so popular on the Continent of Europe, and so seldom grown in this country.

F. grandiflora, the Large-flowered strawberry, is a native of South America, and on the Pacific coast extends northward to California. The Chilian strawberry (*F. Chilensis*) is now regarded as a form of this.

F. Virginiana, the Virginia or Scarlet strawberry is our most common wild strawberry. It is found from the Arctic circle to Florida, and extends northward to Oregon and Washington Territory. Occurring in a great variety of localities, several of its forms have been described as species. This and *F. grandiflora* are the parents of the strawberries generally cultivated. They differ from the Alpine species in having their seeds in a cavity more or less deep. The other species which have been described as distinct are of no importance to the cultivator.

The strawberry was apparently known to the Romans only in its wild state, for none of their writers have mentioned it as among cultivated fruits. It is first mentioned as having been cultivated in England during the reign of Richard III, in 1483. With the exception of a variety of Wood strawberry raised in France about 1660, no improved variety of the strawberry was known until late in the last century, after the introduction of the Large-flowered and the Virginia strawberries. With the production of improved seedlings, as well as hybrids, new

varieties increased rapidly both in this country and in Europe, varieties of the former species seeming to be better adapted to the climate of Europe, while those of the latter are preferred in this country.

The wild berry is vastly superior to most of the new varieties, which the mania for size, regardless of the more valuable qualities of flavor, and aroma, has developed.

All the wild species and most of the improved varieties have perfect flowers. They contain both stamens and pistils, and are termed hermaphrodite flowers. In the strawberry, the numerous pistils are crowded upon a rounded body in the centre of the flower, called the receptacle. Immediately around these are the numerous stamens. As soon as the pistils are fertilized by the pollen from the stamens, they begin to grow, and the lower part of each one ripens into a diminutive, bony, one-seeded nutlet, which popularly passes for the seed, and it is convenient, for the sake of brevity, to call it so. As the pistils themselves, after fertilization, begin to ripen, the receptacle on which they are placed begins to grow, and at length becomes the juicy, fine flavored mass with which we are familiar as the strawberry, though in structure it is not the fruit, but merely an appendage to the proper fruits. Unless the pistil is fructified by the pollen of the same, or of some other flower, through the medium of insects or of the wind, it must remain sterile, or fruitless, or "blind." The flowers of some of the improved varieties, particularly those originating in this country, are entirely without stamens, or have them imperfectly developed. Such are the "pistillate" varieties, as for instance the old "Hovey's Seedling," and the later "Crescent." Having no stamens, they must be fertilized by pollen from other flowers and we must plant at least one row of a perfect variety to each ten rows of the pistillate kind, for that to become fruitful. There are many disadvantages connected with the cultivation of these pistil-

late varieties, and as there are many as good, or better, with perfect flowers, the former should be discarded.

VARIETIES AND YIELD.

A variety may be adapted to a certain soil and climate, and be totally unsuited under different conditions not very distant. Of the many varieties that are fine and popular at the North, few succeed under the continued heat and dryness of a part of our summer season.

The principal requirements of a market variety for shipment to distant points are:

First, Its adaptability to our climate.—Second, Productiveness.—Third, Fair size.—Fourth, Sufficient firmness to enable it to endure the rough handling and delay of transportation without injury, so that it may arrive in market in good presentable appearance and condition.

The old "Wilson's Albany," or "Wilson," and the "Neunan" or "Charleston" meet these conditions better than any others. The latter is a more attractive and better flavored berry, is more productive of runners, and is rapidly superseding the "Wilson" as the Southern market variety.

Where all the conditions for its successful culture are favorable, the strawberry has long been, in the vicinity of large cities, the gardener's most valuable crop.

As long ago as 1850, the average net profit of a Scotch acre * of strawberries in the vicinity of Edinburgh was from one hundred and seventy-five to two hundred dollars, the land renting at from twenty-five to seventy-five dollars per acre.

The heaviest shipments to our Northern markets are made from Norfolk, Virginia, where probably the largest strawberry farm in the world is located, one cultivator having two hundred and fifty acres in this fruit. Large

* The Scotch acre contains six thousand and eighty-four square yards, and is about one and a quarter acre English.

shipments are also made from Charleston, S. C., to the Eastern markets, and from Mobile to those of the West. In 1879, seven hundred and thirty-four thousand and ninety-three quarts were shipped from Charleston. Extensive plantings for shipment have also been made in Florida and South-western Georgia, one farmer having twenty acres near Thomasville, Thomas County.

Although there are lands to be had in the vicinity of Savannah, with adequate drainage, and so admirably adapted to the cultivation of strawberries, that the best fruit farms in the country could be established in this locality, not enough are grown to supply the local demand, and supplies for that purpose are procured from Florida and Charleston. In the local market the retail price ranged from fifteen cents to one dollar per quart-basket the past season, averaging thirty cents. The first sales were made February 20th. The first shipments from Florida, about February 1st, that arrive in good order in the Northern market, sometimes bring from three to five dollars. Larger shipments of one hundred quarts and upwards generally bring about two dollars. Heavier, and later shipments, soon reduce the price.

From Charleston, the first shipments, coming late in March, bring from seventy-five cents to one dollar per quart, but the price drops, as the quantity increases, to from thirty-five to fifty cents per quart.

The first from North Carolina bring about the same price as Charleston berries. The immense quantities shipped from Norfolk, commencing about May 10th, notwithstanding the fresher state of the fruit, bring the price down to from twenty-five to thirty-five cents, and sometimes lower still.

New York is the best market for strawberries. No fancy prices are realized in Baltimore.

Occasionally we enjoy in the latitudes of Savannah and Mobile a sufficiently protracted period of warm weather

in winter for the plants to bloom and mature fruit, enabling us to make several pickings in December, but this occurs very rarely.

G. H. Baker, of Illinois, reported having raised two hundred and fifty-three bushels, or eight thousand and ninety-six quarts of "Wilson's Albany," upon an acre, giving him a clear profit of fifteen hundred and nine dollars. Mr. Parker, of Massachusetts, picked three thousand two hundred quarts of the same variety from an acre within ten days, and sold them on his premises for eleven hundred and twenty dollars. The well-known authority on the strawberry—Rev. E. P. Roe, of Orange County, N. Y., in his work "Success with Small Fruits," mentions the yield of one of his beds of the "Crescent Seedling," at the rate of three hundred and forty-six bushels, or eleven thousand and seventy-two quarts to the acre. A few years ago, O. B. Galusha reported, in an Illinois journal, that he had produced fourteen thousand quarts of the same variety to the acre. These exceptional crops are merely given to show the capabilities of the strawberry under favorable contingencies. No such extraordinary yields can be realized in any other than a cool and moist climate, and it is doubtful whether in our hot region, under the most favorable conditions of soil, variety, manure, careful preparation and proper cultivation, without subdrainage and irrigation, more than six thousand quarts per acre can be produced, while three thousand may be considered a good yield, and from fifteen hundred to two thousand are common. One farmer, near Savannah picked eight hundred and ninety-four quarts from two-thirds of an acre and discontinued picking after the price fell below fifteen cents.

SOIL AND ITS PREPARATION.

The selection of soil and location should be made with a view to provide the moisture so absolutely indispensa-

ble for successful strawberry culture. The plant is very deep-rooted, its roots having been traced to a depth of four feet. Surface watering by hand is impracticable, and of no avail, nor are low lying situations, unless susceptible of deep drainage, advisable.

A well-drained, deeply stirred, friable, more or less loamy or clayey soil, with plenty of vegetable matter, will be more retentive of moisture and more suitable than any other. If there be a choice of location, a northern open exposure is to be preferred.

A light, sandy soil, although it will mature the earliest fruit, will produce smaller berries, the picking season will be much shorter, and the entire crop is apt to be killed out during the first summer. This summer killing is the chief drawback to strawberry culture at the South.

If stable manure is to be used, the lighter the land, the more necessity that the manure should be thoroughly rotted, lest the plants grow to vine at the expense of the fruit. This is more likely to occur at the South than in a cooler climate, and heavier applications of manure are therefore more practicable at the North.

While large quantities of strong animal manures are not necessary on already fertile clay soils, they cannot contain too much decaying vegetable matter. If the soil be of proper character, a field which has been planted for several seasons in vegetables, and upon which no weeds and grass have been permitted to go to seed, would give the best chances for success. Such land, after having matured a well-manured cabbage crop, would need no other, and no better fertilization, than a crop of cow peas sown after the removal of the cabbages in May, and turned under a few weeks before the setting of the strawberry plants. In such case the land should be deeply cross-plowed, a subsoil following the turning plow, a deep soil being as necessary as a fertile one. If manure is to be

applied, it must be broadcast, after the first plowing and harrowing, and then be turned under at the cross plowing. Each plowing should be followed by the use of the subsoil plow, and afterwards by the harrow. It is a mistaken idea that the roots of the previous season are either dead or have no functions to perform, for it is in them mainly that the leaves have stored up matter for the future use of the plant. In the preparation of the soil it should, therefore, be borne in mind that it is to serve for several years, and that no subsequent deep stirring during the after cultivation of the crop is practicable.

Composts of muck, or leaf-mould, with stable, cow, or artificial manures are useful. Potash has been found especially beneficial to the crop. Cotton seed is also good.

METHODS OF PLANTING.

Strawberries may be grown by either one of the three methods of:

First, The single hill. Second, The continuous single row. Third The matted bed.

Each has its advantages, but the former is more suitable to this climate, as it renders clean culture less troublesome and expensive, and, although the crop may not be as abundant, finer and larger fruit is produced. It is, therefore, the only method suited to the cultivation of the larger varieties, such as the "Sharpless," the "Bidwell," and others like them.

The field, having been plowed in narrow lands, thirty to forty feet wide, and finely prepared by cross harrowing, is laid off in straight rows three to three and a half feet apart. This may be done by the garden line, or more expeditiously by means of a wheel upon the tire of which are fixed knobs or projections at certain regular distances. The impression of the tire upon the soft soil marks the lines, while those of the knobs indicate

the spots for the insertion of the plants. The wheel is fixed between handles like that of a seed-drill, and has an upright stick in front, which is lined to a set of poles like those used for laying off trenches with the plow. The plants are put out from twelve to eighteen inches apart in the row, and the knobs and wheel are arranged accordingly.

The planting for the continuous row is the same. The difference between the two results from subsequent culture. The advantages of this method, compared with the matted bed are, that the berries will be larger, the cultivation may be partly with the cultivator, and there will be less cutting of vines to be done.

If the matted-bed system is contemplated, slightly elevated beds four feet wide, with intervening paths eighteen inches wide, which act as auxiliary drains, are thrown up by the plow. On these, after they have been raked off, three rows are put out, eighteen inches apart, one running down the centre of the bed, the plants twelve to eighteen inches from each other. The advantages that may be claimed for this method are, the greater number of bearing plants; the fact that after the first year few or no runners will be produced on the top of the bed; that the close growth tends to keep down weeds, and that the soil will not be compacted, and its porosity destroyed by the trampling of the pickers, who gather the fruit.

SETTING OUT THE PLANTS.

Strong, well-rooted plants of the same season's growth, only, should be used for setting out. Long straggling roots may be shortened to suit the general length and that of the dibble or trowel. The latter is to be preferred for planting, as the roots will be spread out, instead of being crowded together in the narrow hole of the dibble. If the plants have been procured

from a distance, it may be advisable to trim away dead leaves and puddle the roots. If they can be taken freshly from a field near by, neither will be necessary. When set out the upper portions of the roots should neither show above the soil nor should the crown be buried, but be inserted to the level of the general surface.

The weather being favorable, the earlier that strong well-rooted plants can be had and be set out, the better will be the growth during the fall and winter, and, therefore, the earlier and more abundant will be the first crop. This planting may sometimes be done as early as the first of August. It is impossible to procure plants from Northern nurseries early enough, which is another reason for preferring those of home growth. If such have been potted and put out in July, a still better first crop may be realized. As there will be no disturbance of the roots in transferring the plants from the pots to the open ground, it may be done regardless of dry weather, should such prevail at the time. Two and a half or three-inch flower pots, filled with soil, are plunged in the beds up to the rim, wherever young plants upon the runner are about to root, and these are kept in place by placing upon the runner a pebble, an oyster shell, or other weight.

Late in September and October is, however, the safest season for putting out unpotted strawberry plants in this latitude; but it may be done through the whole winter and during early spring.

Clean culture is of paramount importance. Unless a farmer be resolved to accomplish this, he had better not attempt a strawberry crop in our weed and grass-growing climate. Its prospective value, its duration, and the cost of preparation are too great to abandon the plantation to grass and weeds, after the first picking season is over. The cost of planting is so great, and when well cared for the crop is so much more productive the second year than the first, that the practice of treating it like

an annual crop cannot be too strongly condemned. It is often the case that this practice is adopted by some, from ignorance, or want of industry, and by others, from want of time or from negligence, during the season of shipping other produce. If, however, during the picking season, a warm, wet spell should prevail, the task of subduing the weeds is not easy of accomplishment. Hon. C. C. Langdon, of Alabama, a good authority on strawberry culture at the South, reported a serious case of the kind in 1868, when it required the work of nine men during six days to clean five-eighths of an acre. The plants, "Wilson's Albany," had been set out in March, 1864, in rows of single hills, four feet apart, the plants being eighteen inches from each other.

During the whole life of a plantation on the single hill system, the cultivator, running shallow, may keep the surface clean and mellow, when not mulched, to within an inch or two of the plants, and the hoe, with hand-weeding, must be relied upon between the plants. A variety, otherwise suitable, like the "Wilson's Albany," that makes few runners, is best adapted to this method, and the runners must be scrupulously removed by a hoe or knife. The plants, instead of exhausting their nutriment in the production of runners, will store up a greater amount for the next crop of fruit, and the stools will enlarge until the leaves of adjacent plants nearly touch each other in the rows. When the continuous row is contemplated, the cultivation is the same during the first season as above described, but after the runners begin to grow, all those projecting out from the line of rows are to be cut away, allowing only such to take root as extend along the line of plants. By this method a continuous narrow bed, ten inches or a foot wide, becomes established. During the third and fourth seasons all new runners must be removed. The cultivation of the matted-bed crop is exclusively by the hoe,

except in the intervening paths, where the plow may be used. During the second season there should be no room for the hoe, and the work should be confined to hand-weeding, when necessary. The soil, in all three methods, should be kept mellow and clean until just before budding or blooming commences, in order to destroy as many of the germs of weeds as possible.

MULCHING.

Immediately after the last working, a mulch should be applied around the plants and over the entire intervening surface. This is done especially to prevent the fruit from becoming splashed with soil by rains. The other benefits of the mulch, already mentioned in a former chapter, will follow incidentally. If possible, the mulch should be thick enough to prevent the growth of grass.

Of our available materials for mulching, pine straw is the best, either whole or cut, as insects are less apt to harbor under it. Sawdust is objectionable because the finer particles will adhere to the fruit, and when rice chaff is used, small graminivorous birds are apt to scratch away berries, as well as a part of the mulch, in search for pieces of the grain. As soon as the fruiting season is over, the mulch must be removed and the crop cleaned and cultivated at whatever cost of labor. It is right here that the fatal neglect generally occurs.

The matted bed requires no mulch the second season, nor should there be any room for it. The closely growing plants will protect the fruit from being soiled. Owing to the crowded condition of the plants, the earlier will be the exhaustion of the soil, and the greater the impossibility of stirring the compacted surface. Hence the bearing of the matted bed becomes so poor that it is generally advisable to plow it up after the second season, and to use the land for some other crop. Plantings,

after the other two methods, are most productive the second season, but remain remunerative two seasons more. After the fourth year, the land should be used for some other crop. New beds should be set out every year to replace those going out of use. Top-dressings of ashes, bone meal and muck, or some other fine compost, the best ingredients of which are susceptible of being leached out and carried into the soil by rains, should be made prior to putting on the mulch. These should be applied each successive season.

PICKING AND MARKETING.

The season for ripening, or for shipping varies more than with any other crop of the truck-farmer. A period of freezing late in the season will destroy any expanded blossoms, or young fruit already formed, and retard the first picking. If there be no black or heavy hoar frost with a low degree of temperature in January or later, the crop will come in early in March. If the roots could be kept moist by irrigation the fruiting season might be considerably prolonged.

Strawberries as far south as Charleston and Savannah should not be fully ripe when picked for shipment. They should not be pulled from the vines and bruised, but the stems should be pinched off, leaving a part attached to each berry. The least handling, and that little, carefully done, will tend to insure good quality and satisfactory prices. The picking must be done directly into the quart baskets in which the berries are to be shipped. The stems and "hulls" (the calyxes), will admit air between the berries and prevent bruising. These baskets are packed in separate tiers, in well-ventilated, locked crates, each holding thirty-two baskets.

It is thought that when the buyer sees fine berries in the top layer he infers there is a good quality throughout the crate, for which reason the best baskets are fre-

quently reserved for "toppers." This practice should be utterly condemned in the case of this fruit as well as in all shipments of vegetables.

INSECTS.

Wherever the common field crickets abound, they become very destructive, injuring many of the ripening fruits at night. See chapter on "Insects." Other in-

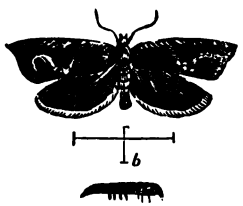


Fig. 66.—STRAWBERRY LEAF-ROLLER (*Anchylopera fragariæ*). *a*, Larva, of real size; *b*, Moth, enlarged.

Fig. 67.—STRAWBERRY CROWN-BORER.

sects particularly infesting the strawberry plant at the South are:

1. *Anchylopera fragariæ*—(The Strawberry leaf-roller).
2. *Emphytus maculatus*—(Strawberry-worm).
3. *Analcis fragariæ*—(Strawberry crown-borer).
4. *Colaspis flavida*—(Strawberry leaf-beetle).
5. *Corimelæna pulicaria*—(Flea-like Negro-bug).

The half-inch long worm of the moth *Anchylopera fragariæ* (fig. 66) lies hidden in the curled-up leaf, upon which it feeds. In consequence of this habit, any efficaceous application of an insecticide is of doubtful use. The second brood passes the winter in the ground in the pupa state. Either of the remedies that have been recommended for destroying the larvæ, by burning off the dead leaves, or by passing a heavy roller over the plants would be more destructive to the crop than any injuries the insects might possibly inflict.

The Strawberry-worm (fig. 68) sometimes injures the leaves considerably. The larva is about half an inch long, of yellowish green color. It feeds generally in a

Fig. 68.—STRAWBERRY WORM (*Emphytus maculatus*).

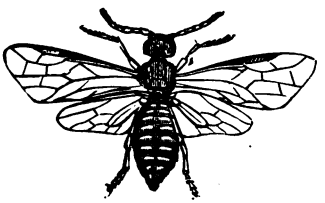


Fig. 69.—FLY OF STRAWBERRY WORM.

curled-up position on the leaf. It winters in the ground as a chrysalid. Its perfect state is a fly (fig. 69).

The snout-beetle (*Analcis fragariæ*, fig. 67) lays its eggs in the crown of the plant, where the young larvæ damage the leaves and fruit stalks. *Colaspis flavida* (figs. 70, 71) is an insect not distantly related to the Colorado

Fig. 70.
STRAWBERRY LEAF-BEETLE.
Larva.

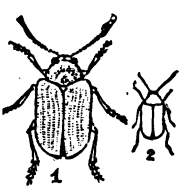


Fig. 71.
STRAWBERRY LEAF-BEETLE.
1, enlarged; 2, real size.

potato-beetle. Lime, first slaked and sifted, dusted on the leaves while yet wet with dew is said to drive away

the worms of *Emphytus maculatus*. Pyrethrum powder may be applied at any time, but Paris green may only be used after the bearing season has passed, in case any of these insects become very destructive.

CHAPTER XXXI.

MUSKMELON, OR CANTALOUPE (*Cucumis Melo*).

***Melon*, French; *Melone*, German; *Meloen*, Dutch; *Mellone*, Italian, and *Melon*, Spanish.**

The Muskmelon came to England originally from Jamaica, but its native country is not satisfactorily known. South of Norfolk it is a very uncertain crop, owing to the necessity for picking it very green; at Savannah, so soon as the skin commences to become rough, and before any change of color takes place. Even then, shipments often reach their destination overripe, and shrinkages are reported. Further south than Savannah, the fruit would, of course, have to be picked still greener and more immature, and would therefore ripen with little of the fine flavor of naturally ripened fruit.

VARIETIES.

The smaller kinds, like the "Jenny Lind," are most salable. The "Green Citron," although larger, is also a popular variety. The "Banana Citron," in small consignments, sold fairly in northern markets during the season of 1886.

SOIL.

Although the Muskmelon will succeed on lower land than the Watermelon, the fruit will carry better and be of better quality when grown on dry, sandy soil. The cultivation is identical with that of the Watermelon. The usual distance of planting the hills is from five to six feet each way. Prof. J. S. Newman, of the Alabama Department of Agriculture, plants on ridges four feet from each other, the plants being eight inches apart. He picked 13,000 melons from an acre in forty-six days.

PACKING.

The smaller varieties may be shipped in half-barrel crates, the larger in barrels or barrel crates. Owing to the length of the fruit—sometimes upward of two feet—the "Banana Citron" requires barrels. To prevent bruising and rotting at the ends, they must be protected with moss or some similar material.

The Muskmelon is subject to the attacks of the same insects as the Watermelon.

CHAPTER XXXII.

OKRA OR GUMBO (*Hibiscus esculentus*).

This vegetable has been regarded as a native of the West Indies, but the recent researches of DeCandolle (*L'Origine des Plantes Cultivées*, Paris, 1883), show that it is undoubtedly of African origin. Okra has long been very popular at the South, but is only gradually becoming sufficiently so at the North to warrant shipments. At present the market would be overstocked by any large consignments. The part used is the unripe tender seed pods, which abound in mucilage, and are used for thickening soups and stews, and is also boiled and dressed with butter, like Asparagus. It is regarded to be highly nutritious.

VARIETIES.

In consequence of the greater convenience in cutting or breaking the pods of the taller growing kinds, these are to be preferred to the dwarf varieties. The long, round Ladyfinger is better than any of the short, fluted sorts. Young Okra plants being quite tender, the seed should not be sown before March 1st.

SOIL.

All the wild species of Hibiscus are generally found on low ground, and the Okra delights in a moist loam or mould, growing to a height of ten or twelve feet on rice-field banks. The crop matures earlier and is better in quality, however, on a lighter and dryer soil. It is sown

on ridges from three to four feet apart, with the plants at a distance of two feet apart. It is difficult to transplant it, as it has but few fibrous roots, and a liberal use of seed is advisable. Its cultivation is like that of cotton, it being of the same family.

PICKING AND PACKING.

The pods should be picked, or cut, when still tender enough to be broken from the stalk. If the point of the pod will not break upon being bent, it is already too tough for the table. The pods are to be carefully packed in either bushel crates or smaller ones, and are sold by the count. The plant is virtually free from insect depredations.

CONCLUSION.

Some of the truck-farmers near the large cities, principally those planting on a smaller scale, grow a general assortment of vegetables and attend the local markets.

Owing, however, to the numerous "patches" in the vicinity, and the competitions they cause, this attendance has of late years been unsatisfactory. Nearly all the farmers grow Ruta Baga or Swedish Turnips in the fall for sale to the retail grocers in the winter, the price being twenty-five cents for eight bunches.

Another source of income is the hay crop. The heavily manured fields produce a thick growth of Crab-grass, which may be mowed several times during the season, making good hay when cut at the proper time. Unfortunately for the reputation of this product, many farmers defer cutting the grass until it is too old to make hay of the best quality. The price is fifteen dollars per ton. The crop of one of the farmers in this vicinity in 1882 was valued at two thousand dollars.

Apart from the neighborhood of cities truck-farming is generally an adjunct to cotton planting. In Florida, it is an adjunct to orange growing. In southwestern Georgia, along the line of the Savannah, Florida, and Western Railroad, in parts of Florida and at other extreme southern points, the fields, after having yielded early vegetables for shipment, sometimes produce the most satisfactory portions of the cotton crop, owing to the previous manuring and careful working of the land.

APPENDIX.

ANALYSES AND VALUES OF FERTILIZERS.

The truck-farmer is forced to use to a greater or less extent some kind of artificial fertilizer. The following circular, issued by the Department of Agriculture of the State of Georgia, contains information of value to all who purchase and use fertilizers. The circular as issued by the Department contains a column giving the names of the persons for whom the inspection was made. As this information has no permanent value, it is omitted for the purpose of saving space. Some other unimportant omissions have been made in reproducing the circular.

ANALYSES AND COMMERCIAL VALUES OF COMMERCIAL FERTILIZERS AND CHEMICALS,

Inspected, Analyzed and Admitted to Sale in Georgia to January 10, Season of 1882-3.

DEPARTMENT OF AGRICULTURE,
ATLANTA, GA., January 20th, 1883.

EXPLANATIONS OF THE TABLES OF ANALYSES.

The tables commencing on page 254 show the analyses and calculated relative commercial values of all fertilizers and chemicals inspected, analyzed and admitted to sale, to January 10th, 1883.

In addition to the chemical determinations and commercial values, a column has been added which shows the numbers of tons represented by the samples whose

analyses are given. This information may sometimes be important to farmers and other purchasers.

RELATIVE COMMERCIAL VALUES.

After very extended correspondence and careful consideration, it has been thought proper to reduce the valuations of ammonia and phosphoric acid from those of last season. The following prices per pound of the valuable ingredients or elements of plant food found in the fertilizers by analysis, have been adopted as a practical approximation to their true value at Savannah, viz:

Available Phosphoric Acid. .....10 cents per pound.
Ammonia.....20 cents per pound.
Potash..... 6 cents per pound.

Last season the valuations were:

Available Phosphoric Acid.....12½ cents per pound.
Ammonia.....25 cents per pound.
Potash ..... 6 cents per pound.

It is often desirable to know the relative amounts paid by a farmer for the several valuable ingredients in a ton of fertilizers. The following is a simple rule: Multiply the per centage of ammonia, as given in the tables, by $4.00, the available phosphoric acid by $2.00 and the potash by $1.2, or $1.1-5, and the respective results will show the value of each ingredient in a ton. Thus: Suppose a fertilizer analyzes as follows:

Available Phosphoric Acid.....9.27 per cent.
Ammonia ....2.15 per cent.
Potash .....1.85 per cent.

Then :

9.27 multiplied by 2		$18.54
2.15 " " 4.....		8.60
1.85 " " 1.2		2.22
Tota'		$29,36

TABLES OF ANALYSES AND RELATIVE COMMERCIAL VALUES OF COMMERCIAL FERTILIZERS, CHEMICALS, ETC., INSPECTED, ANALYZED AND ADMITTED TO SALE IN GEORGIA TO JANUARY 10, SEASON OF 1883.

TABLE I.—AMMONIATED SUPERPHOSPHATES OF LIME.

NAME OF BRAND.	Moisture at 212° F.	PHOSPHORIC ACID. Insoluble.	Soluble.	Reverted.	Total Available.	Ammonia.	Potash.	Relative Commercial Value.	No. of tons represented by the samples analyzed.	BY WHOM AND WHERE MANUFACTURED.
Ammoniated Dissolved Bone	11.43	1.61	7 85	3 88	11.73	2.87	....	$34 94	400	John Merryman & Co., Baltimore.
Angier's Cotton Fertilizer	14.00	0.75	5.05	4.31	9.36	2.73	2.05	32 10	10	Edisto Phosphate Co., Charleston, S. C.
Arlington B	12.25	1.10	7.62	2 33	9.95	2.46	1.65	31 72	50	Dambman Bros. & Co., Baltimore, Md.
Baldwin & Co's Amm. Diss'd Bone	13.25	1.15	10.00	1 10	11.10	3.18	2 10	37 44	200	Baldwin & Co., Newark, N. J.
Ben Hill Ammoniated Bone	12.75	2.40	9.06	1.76	10.82	3.05	2.70	37 08	50	Savannah Guano Co., Savannah, Ga.
Bradley's Pat. Super-Phos. of Lime	12.75	2.00	6.05	3.45	9.50	3.16	1.52	33 46	100	Bradley's Fertilizer Co., Boston, Mass.
Champion Cotton Grower	15.00	2.25	5.62	2.79	8.41	2 30	1.55	27 88	50	L. Seldner & Son, Baltimore.
Chesapeake Guano	12.55	6.35	2.05	5.60	8.00	2.68	0.75	27 62	41	Chesapeake Guano Co., Baltimore, Md.
Crescent Bone Fertilizer	13.95	1.20	10.04	1.01	11.05	3.15	2.00	37 10	101	Baldwin & Co., Newark, N. J.
Cumberland Super-Phos. of Lime	16.25	1.08	6.92	4 38	11.30	2.20	2.70	34 64	250	Cumberland Bone Co., Portland, Maine.
Excelsior	12.25	0.15	10.18	3.09	13.27	3.00	0.85	39 56	50	Savannah Guano Co., Savannah, Ga.
Etiwan Guano	12.25	0.90	6.05	3.95	10.00	2.00	2 00	30 40	150	Etiwan Phosphate Co., Charleston, S. C.
Edisto Ammoniated Fertilizer	14.00	0.75	5 05	4.31	9 36	2.73	2.05	32 10	100	Edisto Phosphate Co., Charleston, S. C.
Farmers' Friend Fertilizer	13.65	0.78	7.48	2.79	10.27	2.31	1.00	30 98	30	Read & Co., New York.
Ga. Patapsco Ammo'd Diss'd Bone	10.80	2.40	4.05	8.25	12.30	3.05	0 75	37 70	100	Georgia Chemical Works, Augusta, Ga.
Georgia State Grange Fertilizer	13.75	1.15	10.05	1.03	11.08	3.15	2.15	37 34	200	Baldwin & Co., Newark, N. J.
Gossypium Phospho	12.15	2.25	8.42	2.04	10.46	3.09	2.00	35 68	1000	Geo. W. Scott & Co., Atlanta, Ga.
L. & R. Guano	12.50	2 15	6.82	2.63	9.45	2 60	3.04	32 95	10	Lorentz & Rittler, Baltimore, Md.
Liebig's Ammoniated Diss'd Bone	15.60	0.35	7.14	3.72	10.86	2.19	1.00	31 68	10	Patapsco Guano Co., Baltimore, Md.
Lister Bros'. Standard Fertilizer	13.20	1.14	10.00	1.12	11.12	3.10	2.20	37 28	103.5.6	Baldwin & Co., Newark, N. J.
Lowe's Georgia Formula	10.85	4.05	4.60	5.80	10.40	2 62	1 25	32 78	200	Georgia Chemical Works, Augusta, Ga.
Mastodon Guano	10.70	2.35	4.00	8.35	12.35	3.00	0.80	37 66	300	Georgia Chemical Works, Augusta, Ga.
Our Own Ammoniated Bone	12.85	2.45	9.85	0.91	10.76	3.06	2.75	37 06	50	Savannah Guano Co., Savannah, Ga.
Pendleton's Ammon'd Super-Phos.	12.25	1.00	7.03	3.52	10.55	3.52	2.54	38 23	1000	Pendleton Guano Co., Atlanta, Ga.
Plow Brand Raw Bone Super-Phos.	11.85	3.75	7.10	2.35	9.45	2.45	2.58	31 80	500	Walton, Whann & Co., Wilmington, Del.
Patapsco Amm. Soluble Phosphate	12.75	1.50	6 20	5.65	11.85	2.31	1.25	34 44	110	Patapsco Guano Co., Baltimore, Md.
Patapsco Ammo'd Dissolved Bone	9.80	0.35	8.05	5.80	13.85	2.00	1.25	37 20	10	Patapsco Guano Co., Baltimore, Md.
Russell Coe's Am. Dissolved Bone	17.35	1.12	7.15	2.00	9.15	2.21	0.70	28 04	355.5	Russell Coe, Linden, N. J.
San Domingo Guano	13 50	1.20	6.98	3.08	10.06	2.55	....	30 32	200	Williams, Clark & Co., N. Y.
Sea Fowl Guano	12.50	3 25	7.50	1.76	9.26	2.60	2.25	31 62	50	Bradley Fertilizer Co., Boston, Mass.
Soluble Pacific Guano	15.25	0.50	7.25	3.80	11.05	2.55	0.80	33 26	440	Pacific Guano Co., Woods' Hole, Mass.
Soluble Am. Super-Phos. of Lime	12.75	2.20	7.15	2.85	10.00	2.60	1.65	32 38	11	G. Ober, Son & Co., Baltimore, Md.
Stono Soluble Guano	11.90	3.00	6.08	2.27	8.35	3.03	0.75	29 72	150	Stono Phosphate Co., Charleston, S. C.

TABLE II.—ACID PHOSPHATES AND DISSOLVED BONES.

NAME OF BRAND.	Moisture at 212° F.	PHOSPHORIC ACID. Insoluble.	Soluble.	Reverted.	Total Available.	Ammonia.	Potash.	Relative Commercial Value.	No. of tons represented by samples analyzed.	BY WHOM AND WHERE MANUFACTURED.
Acid Phosphate	14 90	0.65	12.65	0.80	13.45	.....	.....	$26 90	50	Imported.
Acid Phosphate, Standard No. 1	13.00	1.30	10.95	1.80	12.75	.....	.....	25 50	5	Ga. Chemical & Mining Co., Atlanta, Ga.
Acid Phosphate, Standard No. 2	13.50	0.35	8.95	3.50	12.40	.....	0.85	25 82	5	Ga. Chemical & Mining Co., Atlanta, Ga.
Acid Phosphate for Cotton	16.25	0 25	10.15	4.45	14.60	.....	.....	29 20	5	Seal, Lawson, Kessler & Co., Baltimore, Md.
Allison and Addison's Acid Phos.	16.55	2.00	9.55	2.32	11.87	.....	.....	23 74	25	Allison & Addison, Richmond, Va.
Angier's Cotton Phosphate	13.50	0 56	7 32	4.20	11.52	.....	1.75	25 14	10	Edisto Phosphate Co., Charleston, S. C.
Ashepoo Acid Phosphate.	10.50	3.75	8.25	3.85	12.10	.....	0.85	25 22	200	Ashepoo Phosphate Co., Charleston, S. C.
Baxter's North Ga. Dissolved Bone	10 80	2.28	7.71	5.46	13 17	.....	1.68	28 36	300	Georgia Chemical Works, Augusta, Ga.
Baldwin & Co's Acid Phosphate	10.25	0.75	10.54	2.10	12.64	.....	.....	25 28	500	Baldwin & Co., Port Royal, S. C.
Bowker's Dissolved Bone	16.50	3.05	6.56	3 42	10.08	.....	1.45	21 90	50	Bowker's Fertilizer Co., N. Y.
Charleston Acid Phosphate	13.75	2.75	9 54	3.33	12.87	.....	0 50	26 34	100	Stono Phosphate Co., Charleston, S. C.
Crown Brand Acid Phosphate	13.50	0.56	7.32	4.20	11.52	.....	1.75	25 14	10	Edisto Phosphate Co., Charleston, S. C.
DeLeon's Dissolved BonePhosphate	11 35	2.60	7 25	4.95	12.20	.....	1 80	26 56	200	Georgia Chemical Works, Augusta, Ga.
DeLeon's Dissolved BonePhosphate	14.10	0.25	10 50	2.15	12.65	.....	.....	25 30	150	Imported.
Diamond Soluble Bone	11.75	3.56	7.85	3.67	11.52	.....	.....	23 04	160	Walton, Whann & Co., Wilmington, Del.
Edisto Acid Phosphate	13.50	0.56	7.32	4.20	11.52	.....	1.75	25 14	100	Edisto Phosphate Co., Charleston, S. C.
Etiwan Dissolved Bone	12 15	2.50	8.65	3.43	12.08	.....	.....	24 16	500	Etiwan Phosphate Co., Charleston, S. C.
Etiwan Acid Phosphate	8.00	2.76	6.40	2.84	10.00	.....	2.15	23 58	350	Etiwan Phosphate Co., Charleston, S. C.
Eutaw Acid Phosphate	12.10	4 06	8.20	5.48	13.68	.....	.....	27 36	500	Ashepoo Phosphate Co., Charleston, S. C.
Gate City	13.25	0.80	7.50	5.60	13.15	0.17	6.05	34 24	50	Savannah Guano Co., Savannah, Ga.
Ga. Chemical Works' Acid Phos.	10.90	2.20	7.65	5.60	13.25	.....	1.75	28 60	1000	.....
Ga. Chemical Works' Acid Phosphate without Potash	5.65	2.25	9.55	5.60	15.15	.....	.....	30 30	200	Georgia Chemical Works, Augusta, Ga.
Ga. Chemical Works' Acid Phosphate with Potash	11.10	3.10	7.35	4.05	11.40	.....	1.65	24 78	100	Georgia Chemical Works, Augusta, Ga.
Ga. State Grange Acid Phosphate	11.80	0.25	9.86	3.40	13 26	.....	.....	26 52	100	Baldwin & Co., Port Royal, S. C.
Ga. State Grange Dissolved Bone	11.55	0.40	12.87	2.25	15 12	.....	.....	30 24	500	Baldwin & Co., Port Royal, S. C.
Goldsmith's Cotton Acid Phosphate	10.50	3.75	8.25	3 85	12 10	.....	0.85	25 22	100	Ashepoo Phosphate Co., Charleston, S. C.
Magnolia Acid Phosphate	10.85	2 21	7 58	5.71	13.29	.....	1.60	28 50	400	Georgia Chemical Works, Augusta, Ga.
Merryman's Acid Phosphate	12.00	0.30	10.00	3.25	13.25	.....	.....	26 50	1000	John Merryman & Co., Baltimore.
Pomona Acid	11.00	2.50	7.55	4.15	11.70	.....	1.75	25 50	100	Georgia Chemical Works, Augusta, Ga.
Potash Acid Phosphate	13.70	2.10	8.15	4.17	12.32	.....	2.40	27 52	10½	Lorentz & Rittler, Baltimore, Md.
Russell Coe's Acid Phosphate	15.90	2.06	7 15	2.85	10.00	.....	.....	20 00	35	Russell Coe, Linden, N. J.
South Sea Acid	13.50	0.56	7.32	4.20	11.52	.....	1.75	25 14	10	Edisto Phosphate Co., Charleston, S. C.
Stono Acid Phosphate	13.75	2.75	9.54	3.33	12 87	.....	0.50	26 34	300	Stono Phosphate Co., Charleston, S. C.
W G & Co.'s Super-Phosphate	10.75	0.85	6.00	6.56	12.56	.....	2 85	28 54	100	Wilcox, Gibbs & Co., Savannah, Ga.

TABLE III.—CHEMICALS AND COMPOUNDS OTHER THAN AMMONIATED SUPERPHOSPHATES AND ACID PHOSPHATES OR DISSOLVED BONES.

NAME OF FERTILIZER.	Moisture.	Phosphoric Acid.				Ammonia.	Potash.	Relative Commercial Value.	No. of tons represented by samples analyzed.	BY WHOM AND WHERE MANUFACTURED.
		Insoluble.	Soluble.	Reverted.	Total Available.					
Kainit							12.15	$14 58	20	Imported.
Kainit							12.35	14 82	300	Imported.
Kainit							12.28	14 74	10	Imported.
Kainit							11.90	14 28	200	Imported.
Kainit							12.30	14 64	449	Imported.
Muriate of Potash							47 15	56 58	10	Imported.
*Pure Ground Bone		21.12				3.89			50	Stern's Fertilizer & Chem. Co., N. Orleans.
*Thompson & Edward's Pure Fine Ground Bone		19.21				2.05			22	Thompson & Evans, Chicago, Ill.

*Raw bone, or bone meal, contains no reverted acid, proper, as it has not been acidulated. The whole of the phosphoric acid is, therefore, reported as "insoluble," though, practically, it is much more available as plant food than phosphoric acid from other sources. A good, finely-ground bone meal is worth about $40.00.

ECONOMY IN FERTILIZATION.

Ever since the Department of Agriculture of Georgia was organized, an effort has been made, through its published reports, to impress upon the farmers of the State the importance of adopting some cheap means of increasing the yield of their crops and at the same time increase the fertility of the soil. The value of pea vines as an improver of the soil has been repeatedly urged upon the attention of the farmers, while the superiority of compost over high-priced commercial manure has been shown by repeated experiments conducted under the auspices of the Department during the last seven years. Formulæ and directions for composting home manures with superphosphate and kainit have been published in the reports of the Department from time to time, and results of experiments with the composts made according to these formulæ published annually since 1875. These results show very conclusively the great economy in the use of the compost, since at one half the cost per acre of the commercial fertilizers, as good yields have been uniformly obtained.

It has generally been admitted that when an experiment has been conducted for five years with uniformly the same results, the question so determined may be regarded as settled.

Experiments have been conducted under the auspices of this Department in every part of the State, under various conditions for six years. In these experiments the compost of superphosphate and kainit with cotton seed and stable manure has been compared every year with the best grades of commercial fertilizers, with results most favorable to the compost.

While pea vines and lime furnish the cheapest and most effective means of restoring fertility to worn soils, and of maintaining it in those not yet exhausted, the compost

of superphosphate and kainit with stable manure and cotton seed furnishes, beyond question, the most economical manure the Southern farmer or planter can apply to his crop from year to year.

Besides supplying plant food in the best and most available forms, the compost exerts a mechanical influence upon the soil not produced by the plain commercial fertilizers. Either the composts or the pea vines will supply all the ammonia needed in our soils; the composts for special manuring of crops, while the pea vines will furnish ammonia and humus to the whole soil. It must not, however, be understood that ammonia is the only important element of plant food supplied by these cheap sources of fertility. On the contrary, they supply all of the elements of plant food. Some of these, however, exist in such small percentages that very large quantities of the substances must be applied to supply these elements in sufficient quantities for the production of maximum crops. The principal deficiency is in the percentage of phosphoric acid contained in pea vines and stable manure. This is supplied by the addition of superphosphate in the compost at the time of putting it up. The pea vines may be manured with superphosphates, and thus at the same time supply this essential element of fertility to the soil, and increase the growth of vines to be returned to the soil.

A comparison of the analyses of the Southern field pea with that of clover, which has been used as a soil-improver so long, shows very slight difference so far as either their feeding or manurial value is concerned. It is not necessary to speak of the value of stable manure and cotton seed as manure. Their value is known to all who till Southern soil.

FORMULÆ FOR COMPOSTS.

If the stable manure and cotton seed have been protected from waste by exposure to rain and sun, the following formula is recommended:

Stable manure	650 pounds.
Green cotton seed	650 "
Superphosphate	700 "
Making a ton of	2,000 pounds.

If the compost is intended for use on soils particularly deficient in potash, the proportion of cotton seed and stable manure may be reduced fifty pounds each, and one hundred pounds of kainit used instead. The formula would then be:

Stable manure	600 pounds.
Cotton seed, green	600 "
Superphosphate	700 "
Kainit	100 "
Making a ton of	2,000 pounds.

These ingredients may be varied in proportions to adapt the resulting composts to different soils or crops, but either of the above will be found to give satisfactory results on every class of soils and on all of our cultivated crops.

DIRECTIONS FOR COMPOSTING.—The ingredients may be mixed either by building up the heap by alternate layers of the ingredients, or they may be thoroughly mixed and then thrown into a heap. In either case water should be freely used on the coarse materials while composting.

The following directions, which have been given in former publications of this Department, have been generally followed by those who have used the compost with most satisfactory results. Most farmers prefer the plan of mixing the ingredients well before placing them in the heap for fermentation. Under this plan the mingling of the ingredients is more complete during the process of

fermentation, and hence its effects are probably more thorough, though both plans have given good results.

Directions for Composting.—Spread under shelter a layer of stable manure four inches thick; on this sprinkle a portion of the phosphate; next spread a layer of cotton seed three inches thick; wet these thoroughly with water, and then apply more of the phosphate; next spread another layer of stable manure three inches thick, and continue to repeat these layers in the above order, and in proportion to the quantity of each used to the ton, until the material is consumed. Cover the whole mass with stable manure, or scrapings from the lot, one or two inches thick. Allow the heap to stand in this condition until a thorough fermentation takes place, which will require from three to six weeks, according to circumstances; dependent upon proper degree of moisture and the strength of materials used. When the cotton seeds are thoroughly killed, with a sharp hoe or mattock, cut down vertically through the layers; pulverize and shovel into a heap, where the fermentation will be renewed, and the compost be still further improved. Let it lie two weeks after cutting down; it will then be ready for use.

The following plan of mixture gives equally satisfactory results: Mix the cotton seed and the stable manure in proper proportion, moisten them with water, apply the proper proportion of phosphate and mix thoroughly, shoveling into a mass as prepared.

There is some advantage in this plan, from the fact that the ingredients are thoroughly commingled during fermentation.

For Cotton.—Apply in the opening furrow two hundred pounds, and with the planting seed seventy-five or one hundred pounds, making in all two hundred and seventy-five or three hundred pounds per acre. If it is

desired to apply a larger quantity, open furrows the desired distance, and over them sow broadcast four hundred pounds per acre; bed the land and then apply one hundred pounds per acre with the seed.

For Corn.—Apply in the hill, by the side of the seed, one gill to the hill. An additional application around the stalk, before the first plowing, will largely increase the yield of grain.

USEFUL TABLES.

A TABLE SHOWING THE NUMBER OF HILLS OR PLANTS IN AN ACRE OF LAND AT GIVEN DISTANCES, FROM 12 FEET BY 12 FEET, TO ONE FOOT BY ONE FOOT.

Feet.	*Per Acre.*	*Feet.*	*Per Acre.*	*Feet.*	*Per Acre.*	*Feet.*	*Per Acre.*
12 0 by 12.0	302	7.0 by 1.6	4,148	4.0 by 3.0	3,630	3.0 by 2.6	5,808
12.0 by 10.0	363	7.0 by 1.0	6,222	4.0 by 2.9	3,960	3.0 by 2.3	6.453
12.0 by 5.0	726	6.0 by 6.0	1,210	4.0 by 2.6	4,356	3.0 by 2.0	7,260
11.0 by 11.0	360	6.0 by 5.6	1.320	4.0 by 2.3	4,840	3.0 by 1.9	8.297
11.0 by 10.0	396	6.0 by 5.0	1,452	4.0 by 2.0	5,445	3.0 by 1.6	9,680
11.0 by 5.0	792	6.0 by 4 6	1.613	4.0 by 1.9	6,222	3.0 by 1.3	11.616
10.0 by 10.0	435	6.0 by 4.0	1,815	4 0 by 1.6	7,260	3.0 by 1.0	14,520
10.0 by 9.0	484	6.0 by 3.6	2,074	4.0 by 1.3	8,712	2.9 by 2.9	5,760
10.0 by 8.0	544	6.0 by 3.0	2,420	4.0 by 1.0	10 890	2.9 by 2.6	6,336
10.0 by 7.0	622	6.0 by 2.6	2.904	3.9 by 3.9	3.097	2.9 by 2.3	7.040
10.0 by 6.0	726	6.0 by 2.0	3.630	3.9 by 3.6	3,318	2.9 by 2.0	7.920
10.0 by 5.0	871	6.0 by 1.6	4.840	3.9 by 3.3	3,574	2.9 by 1.9	9,051
10.0 by 4.0	1,089	6.0 by 1.0	7,260	3.9 by 3.0	3.872	2 9 by 1.6	10,560
10 0 by 3.0	1,452	5.6 by 5.6	1,417	3.9 by 2.9	4,224	2 9 by 1.3	12,672
10.0 by 2.0	2,178	5.6 by 5.0	1,584	3.9 by 2.6	4,646	2.9 by 1.0	15,840
10.0 by 1 0	4,356	5.6 by 4.6	1,760	3.9 by 2.3	5,162	2.6 by 2.6	6,969
9.0 by 9.0	537	5.6 by 4.0	1.980	3.9 by 2.0	5,808	2.6 by 2.3	7,740
9.0 by 8.0	605	5 6 by 3.6	2,272	3.9 by 1.9	6,637	2.6 by 2.0	8,712
9.0 oy 7.0	691	5.6 by 3.0	2,640	3.9 by 1.6	7,744	2.6 by 1.9	9,956
9.0 by 6 0	806	5.6 by 2.6	3,168	3.9 by 1.3	9,272	2.6 by 1.6	11.616
9.0 by 5.0	968	5.6 by 2.0	3,960	3.9 by 1.0	11,616	2.6 by 1.3	13,959
9.0 by 4.0	1,210	5.6 by 1.6	5,280	3.6 by 3.6	3,555	2.6 by 1.0	17,424
9.0 by 3 0	1,613	5.6 by 1.0	7,920	3.6 by 3.3	3.829	2.3 by 2.3	8,604
9 0 by 2.0	2,420	5.0 by 5.0	1,742	3.6 by 3.0	4,148	2.3 by 2.0	9,680
9 0 by 1.0	4.840	5.0 by 4.6	1.936	3.6 by 2.9	4.525	2.3 by 1.9	11,062
8 0 by 8.0	680	5.0 by 4.0	2,178	3.6 by 2.6	4,978	2.3 by 1.6	12,906
8 0 by 7.0	777	5.0 by 3.6	2,489	3.6 by 2.3	5,531	2.3 by 1.3	15,488
8.0 by 6.0	905	5.0 by 3.0	2,904	3 6 by 2.0	6,222	2.3 by 1.0	19,360
8.0 by 5.0	1,089	5.0 by 2.6	3,484	3.6 by 1.9	7,111	2.0 by 2 0	10.890
8.0 by 4.0	1,361	5 0 by 2.0	4,356	3.6 by 1.6	8,297	2.0 by 1.9	12,445
8.0 by 3.0	1,815	5.0 by 1.6	5.808	3.6 by 1.3	9,956	2.0 by 1.6	14,520
8.0 by 2.0	2,722	5.0 by 1.0	8,712	3 6 by 1 0	12,445	2.0 by 1.3	17,424
8.0 by 1.0	5,445	4.6 by 4.6	2,151	3.3 by 3.3	4.124	2.0 by 1.0	21,780
7.0 by 7.0	888	4.6 by 4.0	2.420	3.3 by 3.0	4.818	1.9 by 1.9	14,223
7.0 by 6.6	957	4 6 by 3.6	2.765	3.3 by 2.9	4,873	1 9 by 1.6	16,594
7.0 by 6.0	1,037	4.6 by 3.0	3,226	3.3 by 2.6	5,361	1.9 by 1.3	19,913
7 0 by 5.6	1,131	4.6 by 2.6	3,872	3.3 by 2.3	5,956	1.9 by 1.0	24,454
7.0 by 5 0	1.244	4.6 by 2.0	4,840	3.3 by 2.0	6,701	1.6 by 1 6	19.360
7.0 by 4 6	1,382	4.6 by 1.6	6,453	3.3 by 1.9	7,658	1.6 by 1.3	23,232
7 0 by 4.0	1,555	4.6 by 1.0	9,680	3.3 by 1 6	8,935	1.6 by 1.0	29,040
7.0 by 3.6	1,777	4.0 by 4.0	2,722	3.3 by 1.3	10,722	1.3 by 1.3	27,878
7.0 by 3.0	2,074	4.0 by 3.9	2,904	3.3 by 1.0	13,403	1.3 by 1.0	34.848
7.0 by 2.6	2.489	4 0 by 3 6	3,111	3 0 by 3.0	4,840	1.0 by 1.0	43,560
7.0 by 2.0	3,111	4.0 by 3.3	3,350	3.0 by 2.9	5,289		

TABLE SHOWING THE SQUARE FEET AND FEET SQUARE OF AN ACRE, AND ITS FRACTIONS.

Area.	*Square Feet.*	*Feet Square.*
1 Acre.	43,560	208 1/4
1/2 "	21,780	147 1/2
1/3 "	14,520	120 1/2
1/4 "	10,890	104 1/2
1/8 "	5.445	73 3/4
1/16 "	2,722 1/2	52 1/2

TABLE SHOWING THE AMOUNT OF NITROGEN, PHOSPHORIC ACID, AND POTASH, IN ONE TON OF THE FRESH DUNG AND FRESH URINE OF DIFFERENT ANIMALS, AND ALSO OF THE DRAINAGE OF THE BARN-YARD.

	1 TON FRESH DUNG.			1 TON FRESH URINE.		
	Nitrogen.	*Phosphoric acid.*	*Potash.*	*Nitrogen.*	*Phosphoric acid.*	*Potash*
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Horse	8.8	7.0	7.0	31 0		30.0
Cow	5.8	3.4	2.0	11.6		9.8
Sheep	11 0	6.2	3.0	39.0	0.2	45.2
Swine	13.0	8.2	5.2	8.6	1.4	16 6
Mean	9 4	6.2	4.3	22.5	0.4	25.4
Drainage of barn-yard				3.0	0.2	9.8

TABLE SHOWING CONTENTS OF A HEAP OF MANURE AT DIFFERENT PERIODS, EXPOSED TO RAIN, ETC.

	When put up, Nov. 3.	*April* 30.	*Aug.* 23.	*Nov.* 15.
Total weight of manure in heap	10,000	7,138	7,025	6,954
Water in the heap of manure	6,617	4,707	5,304	5,167
Total organic matter	2,824	1,678	1,064	947
Total inorganic matter	559	753	657	840
Total nitrogen in heap	64.3	68.9	46.3	46.0
Total soluble organic matter	218	305	277	190
Total insoluble organic matter	2.576	1,373	857	757
Soluble mineral matter	154	204	188	130
Insoluble mineral matter	405	549	519	710
Nitrogen in soluble matter	14.9	21.4	13.2	12.9
Nitrogen in insoluble matter	49.4	42.5	33.1	33.1

TABLE SHOWING WEIGHT OF MANURE PER BUSHEL, AND PER LOAD OF 50 BUSHELS.*

No.	KIND AND CONDITION OF MANURES.	*Weight of Bushel in lbs.*	*Weight of Load of 50 bushels.*
		lbs.	lbs.
1.	Fresh horse-manure free from straw	37½	1875
2.	" " " " " " pressed	55	2750
3.	Fresh horse-manure, as used for bedding pigs	28	1400
4.	" " " " " " pressed	46	2300
5.	Horse-manure from pig cellar	50	2500
6.	" " " " " pressed	72	3600
7.	Pig-manure	57	2850
8.	" " pressed	75	3750
9.	Pig-manure and dry earth	98	4900
10.	Sheep manure from open shed	42	2100
11.	" " " " " pressed	65	3250
12.	Sheep-manure from closed shed	28	1400
13.	" " " " " pressed	38	1900
14.	Fresh cow-dung, free from straw	87	4350
15.	Hen-manure	34	1700
16.	" " pressed	48	2400

* Harris' "Talks on Manures."

INDEX.

PAGE

Acid Phosphate of Lime..... 41
Allium cepa..... ...181
Ammonia, loss from Manure pile.. 27
How taken up..... 18
In different Soils.... 22
In the Air..... 18
In Surface Soil only..... 23
Salts of... 52
Value of..... 253
Ammoniated Superphosphate..... 42
Analysis of Cow-pea..... 21
Ash.... 21
Ashes, Use of..... 48
Ash of Roots left in the Soil..... 20
Asparagus officinalis.....119
Asparagus..... 119
Bunchers.... 127
Insects Injurious to.....129
Raising Plants. 121
Saving Seed of.....128
Varieties..... 120
Atwater, Prof., on Fertilizers 36
On use of Potash Salts 44
Barn-yard Manure..... 31
Bast, Cuba..... 128
Beans—Bush or Snap.....130
Insects Injurious to.....133
Varieties of. 130
Beet..... 134
"Bassano,"..... 134
"Early Blood Turnip,".....134
"Egyptian,"..... 134
Beta vulgaris.... 134
Blue Bird a Destroyer of Insects... 116-119
Bone Meal.... 42
Borecole..... ... .178
Boussingault on Nitrogen..... 11
Box for Tomato Plants..... 224
Brassica oleracea..... 137
var. *Botrytis*.....163
var. *sabellica*..... 178
Cabbages..... 137
Analysis of.. 144-149
Club-foot in..... 143
Cabbages, Cow-peas for..... ...145
Distance apart..... 147
Injured by Magnesium..... 44
Insect Enemies of.....152
Manures for.. 144
Packing 149
Puddling.... 147
Seeds and Sowing.. 140
Soils for.....142
Sowing in place.....146
Transplanting.....146
Cabbage, Varieties of.....137
"Brunswick,"..... 138
"Early Summer,"..... 138
"Flat Dutch, American,"..139, 151
"Fottler's Brunswick,"..... 139
"Jersey Wakefield,".... 139
"Schweinfurth,"..... 138
"Winningstadt,"..... 138
Carbonic Acid in Soil..... 13
Cauliflower.....163
Cutting and Packing.....168
Protecting..... 168
Varieties... 165
"Algiers,"..... 166
"Early Paris,"..... 167
"Short-stemmed Lenormand,".167
"Snowball,"..... 165
"Very Early Dwarf Erfurt,"..167
Chenopodium ambrosioides, var. *Anthelminticum*..... 60
Chloride of Magnesium 44
Chuck-will's Widow and Spring.... 76
Citrullus vulgaris.....229
Clover, Analysis of..... 149
Cold Frames 72, 80-81
Composting Manures..... 28
Materials for..... 28
Cotton Seed as Cattle Food..... 37
Injurious to Swine..... 37
In Compost..... 37
Cotton-seed Meal, Value as Manure 29
Cow, Manure..... .. 31
Annual Product..... 32
Urine from, Annually.. 32
Cow-pea, Analysis of Vine.... 21

Cow-pea, Analysis of Ash.... 21
Compared with Clover..... 146
Constituents of One Ton..... 22
Green, Manuring with.. 19
Hook to Turn Under..... 25
Mulching with..... 23
Nitrogen in..... 21
Plowing Under..... 24
Roller to Cut.... 25
Cow-penning, Utility of..... 32
Crate, a Barrel..... 94
A Bushel..... 92
Crates, Blocks for Making..... 94
Crops, Rotation of..... 54
To follow in Rotation..... 57
Cuba Bast..... 128
Cucumber..... ...169
Improved White Spine.....170
Insects Attacking..... ..173
Seed Saving..... 172
Cucumus sativus.....169
Cucurbita pepo 209
Cultivation, Benefits of.....14-15
Cut-worms Absent from Cow-penned Land..... 33
Cynodon Dactylon... 61
Cyperus rotundus, var. *Hydra*..... 60
"Deaconing" Packages..... 91
Dew.... 72
Dibble, Use of..... 85
Drainage..... 11
Drain-water, Nitrogen..... 23
Earth Closets, Manure from... 40
Economy in Fertilization.....257
Egg Plant 175
Entomology, Importance of 97
Eupatorium fœniculaceum..... 60
Excrement, Yearly, of Man..... 39
Contents of.. 40
Value Depends on Food..... 29
Fall Plowing Not Useful..... 12
Fertility Improved by Preventing Evaporation.... 23
Fertilization, Economy in 257
Fertilizer, Definition of..... 17
Fertilizers, Analyses of..... .232
Ashes Leached and Unleached. 48
Ashes, Constituents..... 48
Bone Meal..... 42
Cotton Seed..... 37
Commercial..... 36
Conditions of Use..... 36
Fish-scrap..... 38
Fertilizers—Fish-guano..... 38
Guano, Peruvian.... 34
Chincha..... 35
Guanape..... 35
Gypsum..... 51
Kainit.... 44
Land Plaster..... 51
Laws Concerning..... 35
Lime..... 48-49
Muck. 41
Night-soil..... 39
Nitrate of Soda... 52
Nitrogenous..... 52
Value of 52
Potash..... ... 43
Potash Salts.. 44
Ashes Preferred to 48
Chlorides 47
Composition of..... 45
Sulphates..... 46
Using..... 47
Poudrette 40
Prof. Atwater on..... 36
Salt.. 50
Soda, Nitrate..... 52
Superphosphate of Lime..... 41
Florida, Vegetables from, in 1882.. 5
Forbes, Prof. S. A., on Blue Birds. 116
Fragaria Chilensis..... 237
grandiflora.....237
vesca..... 237
V.rginiana.....237
Frost..... 73
Indications of..... . 75
Table of Last 76
Germination of Seeds 62
"Grass,"... 121
Grass, Salt-Marsh, Value of. 33
Green Manuring..... 19
Guano—see Fertilizers..... 34
Guinea Squash.... 175
Gypsum..... 51
Hand-weeding..... 15
Hay, Analysis of 33
Hoeing..... 15
Hook for Turning Under Cow-peas. 25
Horse, Amount of Excrement..... 29
Hot-beds, Ancient Use..... 71
Construction of..... 78
Rarely Needed..... 72
Humus..... 18
Insects.... 96
Blue Bird Destroys.....116

Insects, Change of Form in.... .. 105
Chrysalis Stage of.....105
Classification of.... 105
Colorado Potato-beetle, Travels.100
Destroyed by Birds.....114
Egg Stage of.. 105
Friendly..... 98
Harlequin-bug, Migration. 100
Hibernating. 99
Imago..... 105
Instincts of..... 97
Larva Stage of..... ..... .105
Migration of.....100
Not Killed by Cold..... .. 103
Parasitic.... 99
Perfect Stage. 105
Pupa Stage of.....105
Rapid Reproduction of.....103
Stages of Life of... 105
Tumble-bug Announces Spring 76
Two-brooded at South.... . 99
Achetidæ..... 114
Acrididæ..... 113
Acronycta oblinita..... 129
Ægeria cucurbitæ.....212
Agrotis Cochranii 108
devastata..... 109
subgothica... 103
telifera..... 107
Analcis fragariæ.....249
Anasa tristis.....212
Anchylopera fragariæ.....249
Anthomyia ceparum.. 190
Aphidius, genus..... 160
Aphides Born Alive.... 104
Aphis brassicæ..... 109
Aphis Lions.....160
Aphis parasites..... ...160
Asparagus-beetle.... 129
Baridius trinotatus.....205
Barn-beetle..... 191
Bean-weevil.....183
Blister-beetles.....133, 206
Botys repetitalis... 101
Bruchus fabæ..... 133
Bruchus granarius..... 194
Bruchus pisi. 194
Bugs, Order of..... 105
Butterflies and Moths... 105
Cabbage-botys 153
Cabbage-butterflies 155
Cabbage Flea-beetle..... ..153
Cabbage Plusia.....154
Insects—Cabbage Plutella.....154
Cabbage-worms, Green.....153
Cabbage-worms, Light-colored..155
Cabbage-worm Parasite.....100
Calosoma calidum.... 113
Capsus oblineatus. 161
Cassida auricalcea..... 219
bivittata. 219
guttata.... 219
Texana..... .102, 178
Celæna ferrugera..... .. 109
Chelymorpha cassidea.....220
Chinch-bug, False.... 161
Cicada..... 113
Clubbed Tortoise-beetle.....206
Coccinella, species of..... ..159
Colaspis flavida.... 250
Coleoptera.....105
Colorado-beetle, False.....178
Corn-seed-worm..... ... .228
Cotton-boll-worm..... 27-228
Crickets..... 114
Crioceris asparagi..... 129
Cucumber Flea-beetle... 173
Cut-worms 106
Dark-sided.....108
Glassy.....109
Greasy 107
Natural Enemies.. 112
Remedies for... 110
Small White Bristly.....109
Western Striped... 108
W-marked... 109
Deloyala clavata.....206
Diabrotica 12-*punctata*.....174, 212
Diabrotica vittata.....173, 212
Diptera.....105
Doryphora juncta..... 101, 178
Emphytus maculatus..... 250
Fall Web-worm..... 133
False C inch-bug..... ..161
Fiery Ground-beetle.....113
Flea-beetle... 173
Golden-eyed Flies..... 160
Golden Tortoise-beetle.. 219
Gortynia nitela 204
Grain Bruchus 194
Grasshoppers.....113
Grass-worm..... 175
Gryllotalpa borealis.... 114
brevipennis.... 114
vulgaris..... 114
Hadena devastata.....109

Insects—*Hadena renigera*.....109
Haltica cucumeris.....173
Harlequin Cabbage-bug.....160
Heliothis armiger.....227-228
Hemiptera.....105
Hippodamia convergens.....162
Hymenoptera.....105
Hyphantria textor.....133
June-bug.....106
Lace-winged Flies.....160
Lachnosterna quercina.....206
Lady-birds, or Bugs.....159-162
Laphrygma frugiperda.....142-175
Lema trilineata.....205
Lepidoptera.....105
Locusta migratoria.....113
Locusts.....113
Lytta marginata.....206
Lytta, species of.....133
Mamestra picta.....156
Melon-worm.....236
Mole-cricket.....115
Mottled Tortoise-beetle.....219
Nerve-winged.....105
Neuroptera.....105
Noctua clandestina.....109
Nysius destructor.....161
Onion Flies.....190
Ortalis flexa.....190
Orthoptera.....105
Paniscus geminatus.....113
Pea-weevils.....194
Phacellura hyalinatalis.....236
Phacellura nitidulis.....175
Pickle-worm.....175
Pieris oleracea.....155
Pieris Protodice.....155
rapæ.....155
Plant-lice.....158
Enemies to.....159
Plant-louse, Fecundity of.....103
Plusia brassicæ.....154
Plutella cruciferarum.....154
Potato-stalk Borer.....204
Potato-stalk Weevil.....204
Pot-herb Butterfly.....155
Pteromalus puparum.....100, 155
Rape Butterfly.....155
Shield-winged.....105
Smeared Dagger.....129
Southern Cabbage Butterfly.....156
Sphinx Carolina.....228
cingulata.....219
Insects—*Sphinx quinquemaculata*.....228
Spilosoma Virginica.....133
Squash-bug.....212
Squash-vine borer.....212
Strachia histrionica.....160
Straight-winged.....105
Strawberry Crown-borer.....249
Strawberry Leaf-beetle.....250
Strawberry Leaf-roller.....249
Strawberry-worm.....250
Striped Cucumber-beetle...173, 212
Sweet-potato Moth.....219
Syrphus Flies.....160
Tarnished Plant-bug.....161
Three-lined Leaf-beetle.....205
Tortoise-beetle.....178
Twelve-spotted Squash-beetle 174, 212
Two-striped Squash-beetle.....219
Two-winged.....105
White Ant, Fecundity of.....103
White-grub.....206
Yellow Bear Caterpillar.....133
Zebra Caterpillar.....156
Ipomœa Batatas.....213
Kale.....178
"Blue Curled.".....179
"Green-curled Scotch."....179
Labor.....7
Hours of.....9
Pay of.....8
Lactuca sativa.....180
Land Plaster.....51
Land Renovation of.....10
Lawes & Gilbert's Wheat without Manure.....56
Lawes, Sir J.B., on Loss of Nitrogen 23
On Nitrogen.....11
On Value of Manure from different Foods.....29
Leaf Mould.....41
Leaves, Office of.....60
Leguminous Plants.....21
Lettuce.....180
"Boston Market."....180
"Tennis Ball."....180
"White Cabbage."....180
Lime, How applied.....50
Liberates Ammonia.....48
Superphosphate of.....41
Liquid Manure.....53
Location of Truck-farm.....10
Longevity of Seeds.....69

Lycopersicum esculentum 220
McAlpine's, Capt. J. W., Hook and Roller 25
Magnesium, Chloride of 44
Injurious to Cabbages 44
Potatoes 44
Manure, Applied in the Hill 31
Barn-yard 31
Composting 28
Constituents of 50 Tons 144
Covered and Uncovered, Value of 26
Cow 31
Constituents of 32
Daily from a 32
Definition of 17
Earth Closet 40
Economy needed in 16
Fermentation, to retard rapid .. 27
Fresh and Decomposed, Composition of 27
Green 19
Importance of 16
In large Piles 28
Liquid 53
How used 54
Loss in 26
Manner of applying 30
Moist, Must be kept 26
Necessary to Success 15
Night Soil 39
Analysis 39
Of Oxen 32
Poultry 34
Rotation needed 58
Sheep 34
Stable 25
New York Street Car 29
Swine 33
Value depends upon Food of Animal 29
Weight of 32
Yield from 10 lbs. each Hay, Oats, and Grass 29
Manures, Relative Value of 33
Kinds and Uses 15
Markets 94
Melons to New York in 1882 5
Menhaden 38
Moss-bunkers 38
Moles, Useful 99
Muck 41
Mulch, Value of Cow-peas for 23
Negro Labor 7
Night Soil 39
Composting 40
From Earth Closets 40
Nitrate of Soda 52
Nitric Acid, How taken up 18
In the Air 18
Nitrogen in Acre of Soil 11
In Cow-peas 21
In Drain Water 23
In Human fæces 40
Urine 40
In Soils 49
Oat Straw, Analysis and Value of .. 33
Onion 181
Analysis of 182
Bermuda 182
"Giant Rocca." 182
"Globe Madeira." 183
Insects Attacking 190
"Italian Queen." 183
"Madeira." 182
Potato 183
"Red Wethersfield." 183
Seeds, Raising 183
Sets 189
"Yellow Danvers." 183
Opuntia vulgaris 62
Oxen, Amount of Manure from 32
Ozone 18
Packing 90
Paritium elatum 128
Pea 191
"Black-eyed" 192
"Early Alpha" 19
"Daniel O'Rourke" 192
"Philadelphia Extra Early" 191
"White Marrowfat" 192
Insect Enemies 194
Penning of Sheep 34
Peruvian Guano 34
Phaseolus vulgaris 180
Phosphates in Urine 33
Phosphoric Acid 41
Value of 253
Pisum sativum 191
Plants, Composition of 17
Endogenous 59
Exogenous 59
Manner of Growth 59
Plaster-land 51
Plowing Deep 11
Fall not Useful 12

Portulaca oleracea..... 61
Potash..... 43
For Potatoes..... 44
Salts..... 44
Value of..... 253
Poudrette..... 40
Poultry Manure..... 34
Potatoes..... 195
"Beauty of Hebron"..... 197
"Burbank"..... 197
"Chili Red"... 197
"Early Rose"..... 197
Diseases of..... 204
Injured by Magnesium..... 44
Insects injurious to..... .. 204
Require Potash..... 44
Second Crop 203
Seed, Size of 197
Pyrethrum Powder.....157
Quick-lime..... 48
Radish 207
"Long Scarlet Short-top"..... .207
"Scarlet Turnip"..... 207
Raffia..... 128
Raphanus sativus. 207
Roller-cutting for Cow-peas..... 25
Roots left in the Soil 20
Rotation of Crops..... .. 54
Points to Aim at..... 57
Russian Black Lands..... 11
Salt, Common..... . 50
Salt-marsh Grass, Analysis of..... 33
Grass for Penning..... 33
Mud for Penning... 33
Savannah, Produce from, in 1882... 5
Schmidt, Prof., on Nitrogen..... 11
Seeds..... . ...62, 70
Depth to Cover..... 70
Drills for.... 70
Failure, Cause of..... . 69
Germination of..... .....62, 67
Heat required..... 67
Home-grown..... ... 68
Keeping of 66
Longevity of..... 63
Quality of..... 63
Roller, Use of..... .. 71
Soaking 67
Sowing..... 62
Testing.. 65
"Treading in".... 71
Sheep Manure..... 34
For Penning..... 34
Sialia Sialis.....116
Snakes, Useful..... 99
Snow, Ammonia in..... 22
Soda, Nitrate of. 52
Soil..... 10
Ammonia in..... 22
How Formed..... 17
Nitrogen in an Acre..... 11
Preparation of..... 12
Stirring, Importance of.. 14
Solanum Carolinense.....101–102
Elæagnifolium..... 102
Melongena..... 175
tuberosum..... 195
Spinach..... 208
Spinacia oleracea..... 208
Spring, Announced by Animals.... 76
Sprouts..... 178
Squash..... .....2 9
"Early White Bush Scallop"..210
"Early Summer Crook-neck"..210
Insects injurious to.....212
Strawberry.. 236
"Charleston"..... 239
"Crescent"..... .....238 241
Culture of..... 245
"Hovey's Seedling"..... 238
Manure for.... 242
Methods of Planting..... 243
Mulching..... 247
"Neunan"..... 239
Setting Plants... 244
"Wilson"..... 239
"Wilson's Albany".. ... 239, 241
Insects injurious to.....249
Picking and Marketing.....248
Sexes of.... 238
Superphosphate, Ammoniated..... 42
Of Lime 41
Sweet Potato..... 213
"Brimstone"..... 213
"Delaware"..... 213
Insects injurious to.....218
"Jersey"..... 213
"Nansemond"..... 213
"Pumpkin Yam"..... 214
Raising "Draws" 214
Raising Seed 217
Yam Varieties..... 213
Thinning Plants..... 15
Toads, Useful 99
Tomato..... 220
Insects injurious to.....238

Tomato Plants, Box for.....224
Picking and Packing,.....226
Raising Plants.....222
Saving Seeds.....228
Transplanting.....225
Varieties, "Acme".....220
"Fejee"... 220
"Hathaway".....220
"Livingston's Perfection"..220
"Pear-shaped".... 220
"Red Cherry".....220
"Round Smooth Red".....220
"Trophy. 220
"Yellow Cherry. 220
"Topping" Packages..... 97
Transplanting..... 82
Utility of 86
Turnip, Analysis of.... 149
Urea, Composition of..... 32
Amount in Urine of Animals... 32
Urine Annually Voided by Cow.... 32
Phosphates in..... 33
Urea in..... 32
Vegetables from Florida in 1882.... 5
Savannah in 1882 5
Vegetable Refuse..... 28
Ventilation of Packages..... 91
Voelcker, Prof..... 11
Wages in Interior of Georgia..... 9
Laborers'..... 8
Walsh, Mr., on Birds 116
Water and Watering.... 87
Watermelon..... 229
Losses on..... 229
"Rattlesnake,".. 231
When, is Ripe. 235
Weather, Importance of Observations... 75
Weeds..... 59
Bermuda-grass..... 61
Coco-grass..... 60
Dog-fennel. 60
Nut-grass..... 60
Prickly Pear... 62
Purslane..... 61
War Against 14
Wormseed..... ... .60
Weight of Manure..... 32
Wheat Unmanured for 20 Years.... 56
Whip-poor-will and Spring..... 76
Woods-earth..... 41

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